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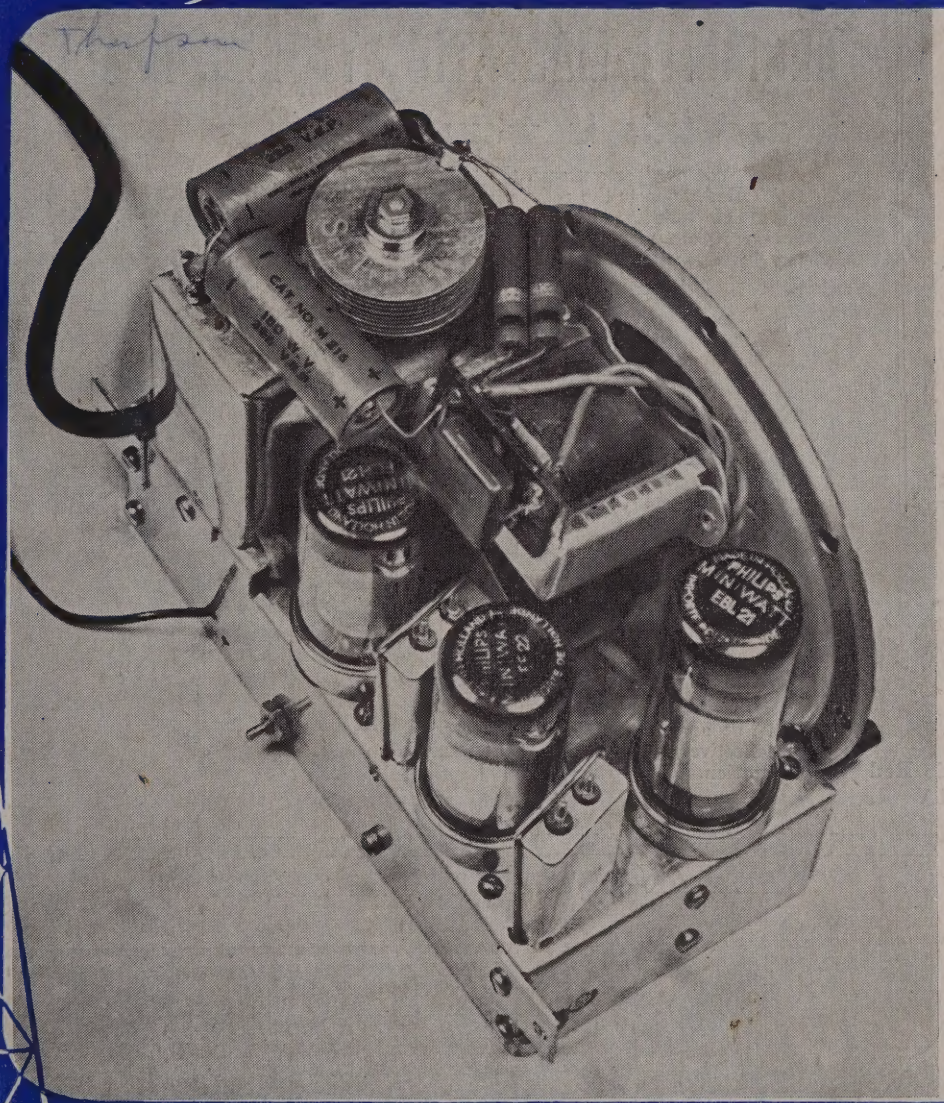

In this Issue:

A Miniature 3-valve A.C. Broadcast Receiver

Inexpensive Distortion Measurement

TV used in Banking Operations

NOVEMBER 1st, 1952 VOL. 7, NO. 9.

1/10

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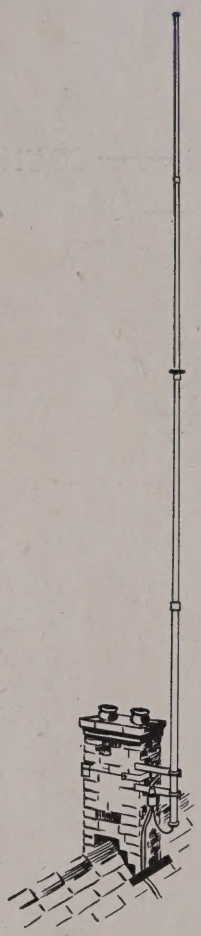

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Radio and Electronics

VOL. 7, No. 9 November. 1952

OUR COVER

This month's cover picture shows a top-chassis view of a miniature 3-valve A.C. receiver described on Page 6 of this issue.

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Television Put To Use In New Zealand

Last month, Mr. B. T. Withers of the Canterbury College School of Engineering, who is the new President of the New Zealand Electronics Institute, addressed members of the Wellington Branch of that organization on the Engineering School's television project. This scheme has already received a good deal of publicity in the daily press, as being the first actual radio transmission of high-definition television to take place in this country, and the fact of its existence will be well known to readers of this journal. What is not so widely appreciated is the reason for its coming into being, and the part it plays in the Engineering School's scheme of training for electrical engineers.

Interesting as Mr. Withers's description was of the technical aspects of the project, it appears that it has considerably more far-reaching and important aspects than simply the novelty and kudos attachable to it as a technical achievement of considerable magnitude. To those who have thought about the matter at all, it must be obvious that a project such as the Canterbury College one, must have involved not only a great deal of work in terms of man-hours applied to it, but also a not inconsiderable sum of money. It is also common knowledge that the University of New Zealand is not, as are many overseas universities, blessed with heavy monetary endowments, and that the finance available for expending on technical equipment is quite limited. As a result, the TV project must, in order to justify itself, play an important part in the work of the Engineering School. How does it justify its own expense, then and what part does it play in the training of electrical engineers? The answers to these questions were given by Mr. Withers in the course of his address, and they give much food for thought.

The Engineering School, it should be pointed out, is not concerned with turning out television technicians, or even electronic engineers. What it does do is to train men as engineers, so that irrespective of the type of engineering in which they ultimately specialize, they can put the letters B.E.(N.Z.) after their names. Moreover, the training provided by the engineering school is of such a standard that the degree of Bachelor of Engineering in the University of New Zealand can more than hold its own in comparison with engineering degrees granted by any university in the world. It does not seem to be generally realized that in engineering circles throughout the world, the New Zealand degree is regarded as one of the best obtainable. Now these complimentary remarks do not report any words of Mr. Withers. They are our own, but Mr. Withers's remarks left no doubt of at least one reason why our engineering degree is held in such high esteem.

In the first place, it is noteworthy that it is not until the final year of the degree course that students are allowed to specialize at all, even into the broad classifications of Electrical, Mechanical, and Civil engineering. Up till that time, the training of all students runs along identical lines, with the result that every candidate for a degree must possess, by the time he begins to specialize, a broad base of general engineering knowledge which is essential if he is to be able, after leaving the university, to tackle any specific engineering problem in a completely realistic and adequate manner. All engineering is based on a sound knowledge of physics and mathematics, and in particular, on the latter, and to a very high standard. In this way, every student is given the wherewithal to appreciate fully any engineering problem, of whatever magnitude and in any field. Still, it will be noted, no mention of television!

The television project, indeed, does not enter directly into a training scheme until the student has graduated, since it is concerned with post-graduate work. After a man has graduated B.E.(Electrical) he may wish to specialize in electronics. His ordinary degree course has given him a quite extensive knowledge of the basic principles of electronic equipment, and his pure and applied electrical theory has provided him with the technical resources needed for any ascent into the realms of detailed circuitry, however complicated or abstruse. Should he, therefore, decide that the electronic side of electrical engineering is his major interest, and should his professors consider that his attainments are sufficient to allow him to take an honours degree, he can take it in electronics, which is where the TV project comes in.

In any department of a university it is essential that research projects should be available as a source of original work for those preparing theses, and this function the TV project is fulfilling admirably. Already, Mr. Withers said, several quite new ideas have been produced by the students who have been working on the project, and one of them bids fair to having important repercussions on the technical side of commercial television. It is a method which enables a standard iconoscope to produce approximately ten times the signal output that the same tube will do with the circuits that are standard at present. Only those who have had practical experience of the difficulties associated with the generation of picture signals will appreciate fully what an important development this is.

The project is expected to produce material for research projects for a considerable time to come, and its secondary effects must be of immense value. The interest it must stimulate among the students will be tremendous, and it may well be the means of leading many of them towards electronic engineering as a specialist subject, whereas the majority of them find their livelihood, after graduation, in the sphere of power engineering. Anything which, like this project, can stimulate interest in electronics is a very good thing, as we have had cause to remark before in these pages, and the fact that so early in the piece, important new developments are taking place in the laboratory at Christchurch impresses on one that here is no mere "playing" with TV on account of its novelty, but something that is of great value, not only to a few honours students, but to the country as a whole. It is to be hoped that those who have done this work will not be forced to take their talent overseas in order to be able to continue working in this most exciting and fast-moving development of electrical engineering.

Great credit is due to Mr. Withers for his enthusiasm in fathering the project, and in proving its value and importance, and it is only fitting that this journal should congratulate him and the honours students who have helped him to make it a success. His address should prove to the Wellington branch of the Electronics Institute that, whatever the difficulties to be overcome, their own decision to press on with a TV project of their own is a right one.

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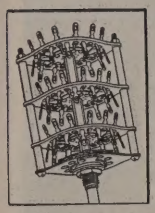
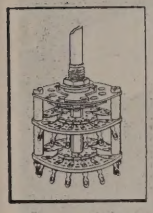


Type "40" Switch



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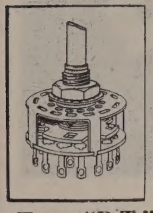

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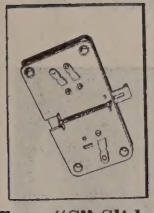

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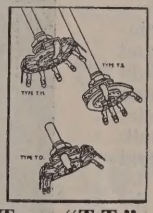

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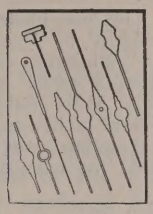
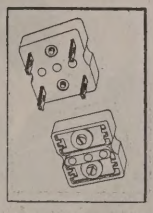


Scale Pointers



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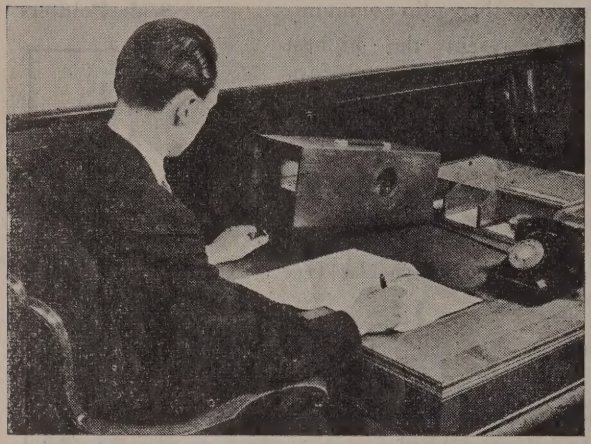
Television Speeds up Banking

The practical applications of television in the purely commercial field were demonstrated in London recently, when a bank with its record and pay offices ten miles away, was able to verify signatures by television.

This was made possible by a television system specially designed by Pye of Cambridge, using their new "Staticon" miniature camera, the dimensions of which are only 11 in. x 6½ in. x 4¾ in. In the Whitehall office of the Glyn Mills Bank, a special viewing set, which could present a life-size or larger picture, had been installed. Ten miles away at the Osterley Park branch of the bank, the television camera was focused on the required



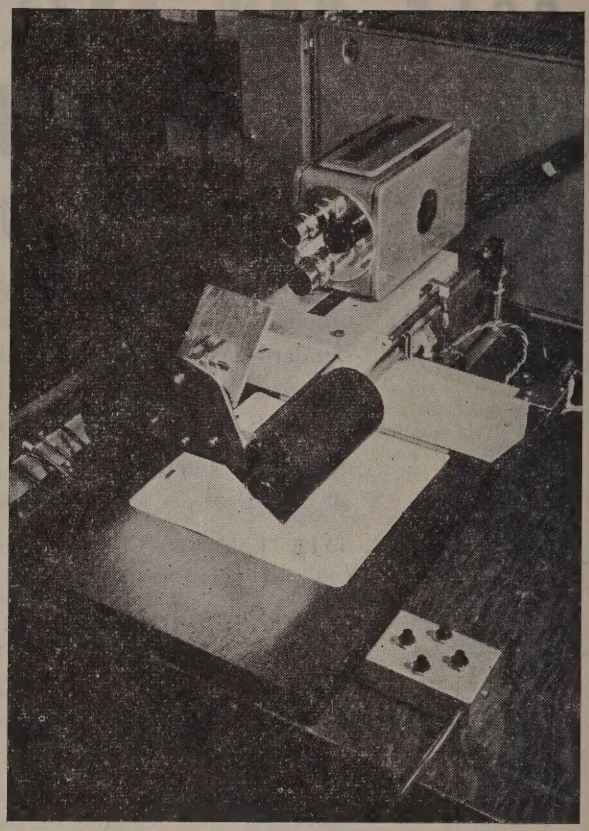
Receiving position, showing the small cathode ray tube on which the images of cheques or other documents are displayed.

document—the page of a ledger or a cheque. Using a Post Office line which also carried any conversation between the two offices, and could be "scrambled," the camera could be moved by remote control over the face of the document, thus permitting close examination. So excellent was the quality of the reproduction, that even the numbers on a page of a telephone directory, a test sample, were clearly discernible.

Previously, such information had to be obtained by special messenger, for, on account of its confidential nature, it could not be discussed over the telephone.

The adoption of this new scheme by the bank concerned, will, of course, depend upon installation and running costs, but after the initial expenditure, it should result in considerable saving in time as well as reduction in running costs and staff. Banks, or other commercial concerns in large cities, would be able to move the bulk of their record offices to the suburbs, where rents and labour are cheaper, and the staff, too, would benefit by living within easier reach of their homes. In fact, the introduction of television in this field would represent one of the most outstanding advances in banking methods in recent years.

Results of this experiment are being closely watched in relation to other possible uses, such as remote observation of industrial processes, in industrial training, news transmitting, prison control, schools, hospitals, and in motion picture production, where rehearsals could be viewed in black and white, thus obviating film wastage due to the necessity for retaking scenes.



Transmitting position, showing the miniature TV camera with its triple turret of lenses and, behind the desk lamp, a mirror inclined at 45° so that the camera views documents placed on the table.

Reproduction of the image of a portion of a cheque, including the drawer's signature. This gives some idea of the excellent fidelity of the images.

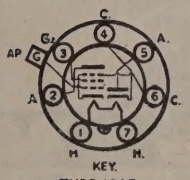
Stuck for a 12A7? - then *BRIMARIZE!

Any of the valve types listed below together with a metal rectifier makes a good substitution for 12A7.

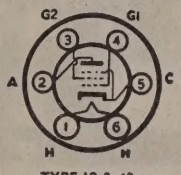
TYPE 18. One of the U.X. types which can often be obtained. Its characteristics at low voltages are identical with those of the 12A7 pentode section. The rectifier section is conveniently replaced by a small SenTerCel selenium rectifier which is easily fixed to chassis or cabinet.

TYPE 43. Another U.X. type which is still being made and whose characteristics, if self bias is employed, are similar to those of the 18. It is advisable to make a small adjustment to the line cord when using type 43.

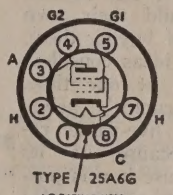
TYPE 25A6G. The International Octal version of the 43, but more readily available at the moment.



TYPE 12A7



TYPE 18 and 43



TYPE 25A6G

TYPE	Change Socket From	Change Socket To	Change Connections From Old Socket	Change Connections To New Socket	Other Work Necessary	Rectifier
18	U X 7 pin	U X 6 pin	Pin No. 1 " " 2 " " 3 " " 4 " " 5 " " 6 " " 7 Top Cap	Pin No. 1 " " 2 " " 3 Rect. + ve Rect. — ve Pin No. 5 " " 6 " " 4	NIL	SenTerCel miniature Selenium Rectifier RM1 may be fitted to chass's or cabinet.
43	U X 7 pin	U X 6 pin	AS ABOVE		Reduce line cord by 40 ohms SEE NOTE	
25A6G	U X 7 pin	Int. Octal	Pin No. 1 " " 2 " " 3 " " 4 " " 5 " " 6 " " 7 Top Cap	Pin. No. 2 " " 3 " " 4 Rect. + ve Rect. — ve Pin No. 8 " " 7 " " 5	Reduce line cord by 40 ohms SEE NOTE	

NOTE—When fixed Bias is used in the receiver it is necessary to insert a 33,000 ohm ½ watt resistor in series with the lead to the screen grid (Pin 3 of type 43 or Pin 4 of type 25A6G) together with a 2 mfd 150 V.W. condenser from screen grid to chassis.

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A Small Three-Valve Broadcast Receiver Circuit

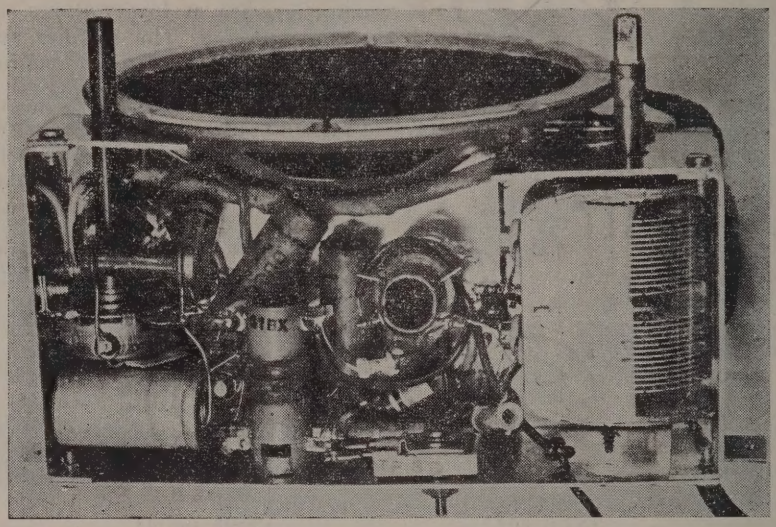
These days there is little to be gained from the monetary point of view in building a five-valve broadcast set rather than buying the commercial product, but when it comes to either large or very small sets, the amateur constructor can not only derive much pleasure from building his own, but can also effect a considerable saving in outlay. The little set described in this article shows what can be done with very few parts, to obtain excellent performance on the broadcast band.

INTRODUCTION

While we do not suppose that all those who build radio sets, large or small, will be interested in making one of the smallest practicable size, it was felt that the circuit of this little set, which was built for a special purpose, might prove of sufficient interest to gain a place in this issue of *Radio and Electronics*.

For some time, it has seemed that those who build their own radio sets instead of buying them, have changed their ideas considerably. For instance, at one time, the amateur constructor's prime favourite was the five-valve receiver, largely because of its simplicity, and because it was possible to purchase the parts needed for considerably less than the price of a commercial five-valver. Thus, as well as deriving considerable pleasure and satisfaction from putting together his own set, the constructor had the added benefit of saving some of his own money in the process. Today, it is still possible to do this with the larger type of set, as the popularity of such articles as the "Radio and Electronics" 1952 Radiogram has amply demonstrated, but the market for designs for five and six-valve circuits seems largely to have fallen off. There are, we think, two main reasons for this. One is that many more home-constructors prefer to spend what money they can raise for their hobby on good audio equipment, building good amplifiers, and buying good gramophone pick-ups, and loudspeakers. The second reason is that it costs just about as much to build a five-valve set these days as it does to buy one, so that the incentive to build one's own has to some extent disappeared.

In spite of this, the production of a really small circuit, with a minimum of valves and components, that will give acceptable performance, both with regard to R.F. sensitivity and A.F. output, offers quite a challenge to anyone's ingenuity. With modern valves at our disposal, not to mention such relatively new components as the small metal rectifiers that are so suitable as H.T. rectifiers at medium voltages, it occurred to our technical staff that a three-valve circuit should be capable of perfectly satisfactory performance. True, it will not give as much power output as a five-valve set, unless it uses the same sort of power supply, but there is no reason why it should. The nominal three to four watts that seems to have become standard for domestic receivers is no magic figure that must be attained at all costs.



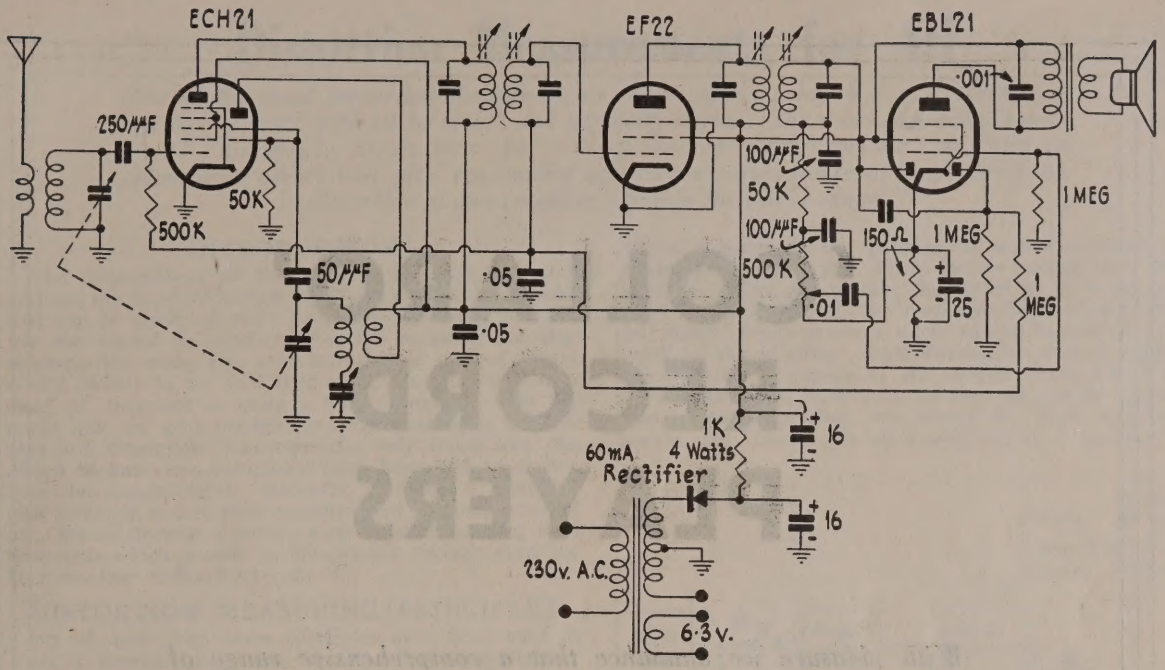
Underneath view of the laboratory model of the set. It is not recommended that all builders should attempt such a compact layout, but as long as all the parts are accommodated without undue crowding, there is no reason why the circuit should be function properly.

Only a few milliwatts are required to give quite respectable room volume.

With this as the main thought behind the circuit design, together with the use of a metal rectifier for supplying the H.T. voltage, the set comes out something like the following.

CIRCUIT DETAILS

To start off with, it will be noticed that the power supply is very small. The power transformer is a 150–0–150-volt, 30 ma. instrument transformer, with one side of the high-voltage secondary unused. A 150-volt, 60 ma. metal rectifier is used in a half-wave circuit, with two 16 μf. smoothing condensers and a 1000-ohm smoothing resistor as the only filtering. The output voltage of this arrangement is almost exactly 100 volts, and this figure makes it possible to use a very simplified R.F. circuit. The 100 volts can be applied directly to the screen-grids of all three valves, and to the oscillator plate as well. This immediately does away with three dropping resistors and three bypass condensers, and accounts for the rather bare look of the oscillator-mixer circuit! Further, with only 100 volts on their plates, it is possibe to run both the mixer and the I.F. amplifier valve without any fixed or automatic bias at all, thus



Circuit diagram of the receiver. The power transformer is a 30 ma. 150v.-a-side, with one half of the secondary unused. The output transformer should match 7,000 ohms to the speaker voice-coil impedance.

disposing of cathode resistors and their bypass condensers for these two tubes.

There is no audio amplifier stage apart from the output tube, which is one of those which has a pair of diodes in the same envelope. One of these is used for detection, and the other for A.V.C. rectification, fed from the detector diode through a 50 μμf. condenser. Incidentally, the condenser referred to failed to have its value drawn in on the circuit diagram. It is the one bridging the two diodes in the EBL21 circuit.

There is unfortunately a second mistake on this diagram, which was not noticed soon enough to have it rectified before we went to press. It is in the detector circuit. The wire that comes from the top of the secondary of the final I.F. transformer is shown joining on to the wire which leads to the screen of the EBL21. The dot indicating a connection should have been a cross-over instead.

Apart from these few things, there is very little in the circuit that calls for special comment. The Continental loctal series has been used, because of the excellent performance of these valves at low plate voltages, and the choice has been amply justified by the excellent performance of the set.

CONSTRUCTION

The photographs on this month's front cover and on this page show how the original was built, and the extreme compactness of the layout can be readily gauged from these. The set was actually built to fit into a very small extension speaker cabinet, and it was more a case of carving the chassis to shape so that it would fit the cabinet, rather than laying out the circuit in the conventional way. However, it can be seen that the arrangement of the circuit follows ordinary lines, except for the power supply part of it. The ECH21 is the valve immediately behind the output transformer (which is mounted on the speaker), while the EBL21 is in the front corner of the chassis, and the EF22 is between the two midget I.F. transformers. Under the chassis, the gang condenser is at the same end as the power supply, all of which is above the chassis, and can be seen quite clearly in the top view.

Should it be desired to mount the rectifier in the same way as is shown in the photograph, the following procedure will have to be adopted. The cover is removed from the transformer, and an $\frac{1}{8}$ in. hole is bored in the position in which it is desired to mount the rectifier.

This hole is countersunk on the inside of the cover, to take a $\frac{1}{8}$ in. bolt with a countersunk head. The bolt is inserted, and the cover put back on the transformer. The rectifier is slipped over the bolt and a nut is used to secure it. There is an insulating sleeve through the centre of the rectifier, so that it is not necessary to insulate the bolt in any way. The negative ends of the filter condensers are soldered directly to the transformer's cover, while one terminal lug of the output transformer primary is used as a tie point for the second condenser's positive end, and the smoothing resistor as well. The output lug of the rectifier is used as a tie-point for the positive end of the first smoothing condenser, and for the input end of the filter resistor.

Of course, there is absolutely no need to construct the set in the same way as the prototype was built. It can be put in a larger cabinet with a larger speaker, and a bigger chassis used, so as to give a more conventional arrangement of parts. There is nothing in the circuit that should cause any constructional difficulties, and the alignment procedure is exactly the same as for any five-valve superhet, with the I.F. cores, the aerial and oscillator trimmers, and the oscillator padder to be adjusted.

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Distortion Measurements for All

One of the most important measurements in the audio field, that of distortion, is one of the most difficult to make, and normally requires the most expensive equipment. This article shows how, for a very modest outlay, anyone can build an instrument which will give reasonably accurate measurements of total harmonic distortion at any frequency within the audio range.

INTRODUCTION

The measurement of distortion in audio amplifiers is perhaps the most important of all the electrical estimates that can be made, of their actual performance, and yet, for one reason or another, it is the measurement that is least often made. This most unfortunate state of affairs is due mostly to the fact that, technically, the measurement of distortion is quite a difficult matter, with the result that the gear needed for accomplishing it is complex and expensive. Consequently, only those who can afford to have this equipment have been able to undertake the measurements. Recently, however, a relatively new principle in distortion measurement has been brought into use to provide a simple method of measuring total distortion which should be inexpensive enough even for keen amateur audio men to afford.

DISTORTION MEASURING PRINCIPLES

Up till now, two main principles have been used in order to measure distortion—the so-called wave-analyser and fundamental suppression. In the wave-analyser, we have what is fundamentally an extremely selective superheterodyne circuit, tunable so as to receive signals from about 50 cycles per second to 50 kc/sec. This receiver is then attached to the output of the amplifier under test, and with a single tone fed into the amplifier from an audio oscillator, the "receiver" is tuned through the audio range. It is then used to observe the presence of, and measure of the amplitude of any frequencies other than the fundamental tone being fed into the amplifier. In this way, the presence and amount of any harmonic of the original tone can be found and measured. Should there be no distortion whatever, there will, of course, be nothing in the output but the original tone, and this fact will be revealed by the wave-analyser. Now an instrument which will perform this function easily and well is an exceedingly difficult thing to design and build, with the result that such instruments are very costly indeed, and within the means of only the larger laboratories to purchase. Added to this, even if you have one, it is slow to use, and needs careful manipulation if the answers are to be correct ones. Besides, the audio oscillator used as the signal source must be entirely free of harmonics, or else these are measured along with those produced by the amplifier under test, and are debited against it. The wave-analyser technique was for a long time the only method known of measuring distortion, and for many years the instruments available were not capable of giving accurate measurements of extremely small quantities of distortion—of the order of fractions of one per cent. However, the improved instruments available today are very fine indeed, and extremely sensitive, and for precise measurements are still the best thing available, so that wave-analysers still have an important place to fill in the scheme of things.

Some years ago, however, the need was felt for something that would be quicker to use, and which would give a reading of total harmonic distortion, at the turn of a switch, as it were. Accordingly, there were developed several distortion factor meters, as they are called, that after they have been properly set up, give a direct reading on a meter of the quantity of distortion produced by the device under test. These meters worked on a new principle, which was to take the output to be tested, remove the fundamental, and measure the remaining output, which ideally consists solely of the harmonics produced by the amplifier. Such instruments employ filters, tuned to the frequency of the original tone, which do not attenuate the harmonics to any appreciable extent. This means that they are essentially fixed-frequency devices, for, unlike the wave-analyser, it is possible to use as test frequencies only those for which filters have been provided. Comprehensive instruments of this kind provide a wide range of spot frequencies to counteract this disadvantage, but in general, this means a great deal of duplication of equipment, and still results in an expensive instrument, even if the number of spot frequencies is restricted to three, which is about the minimum practical number. Other fundamental-suppression instruments have continuously tunable circuits, but this again is a difficult technical problem, so that these too are very costly devices.

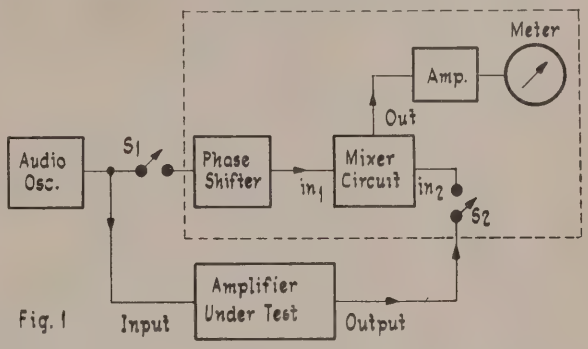


Fig. 1

The present arrangement, too, works on the principle of removing the fundamental frequency, and measuring what remains after this has been done, but the difference between this and previous methods lies in the way in which the fundamental cancellation is performed. Instead of having a sharply tuned filter, the fundamental is removed by the simple method of mixing it with the output waveform in such a way that the fundamental components are exactly out of phase, and so cancel out for that reason. It is obvious that when this is done, there need be no parts of the equipment that are tuned, so that the system is able to work at any frequency within the audio range, and this in turn means that the circuit is greatly simplified in comparison with most fundamental-suppression devices.

PRINCIPLE OF THE DISTORTION METER

In Fig. 1, we have a block diagram of the distortion meter. The audio oscillator is not part of it, but is necessary, as with all other methods. It is fed into the amplifier under test, which is adjusted for the output power at which the measurement of distortion is required. By means of S_1, the output of the oscillator can also be

applied to the input terminal of the distortion meter, which comprises all that part of the diagram within the dotted line. The first circuit in the distortion meter consists of a phase shifter, which allows the phase of the input sine-wave to be altered by any desired extent. This feeds into the mixer circuit, while the output of the amplifier under test feeds into the second input terminal of the mixer. The output of the mixer excites an amplifier, which is followed by a V.T. voltmeter, which can be built into the device itself, or can be any separate V.T.V.M., or even an oscilloscope.

In order to see how the system works, let us assume for the moment that the signal is a pure sine-wave, and that the amplifier being tested produces no distortion at all. The method of operation is as follows:—

(1) S_1 is closed and S_2 is opened.

(2) The volume control at In_1 of the mixer is adjusted so that the V.T.V.M. shows, say, 100 volts.

(3) S_1 is opened, and S_2 is closed.

(4) The volume control at In_2 of the mixer circuit is adjusted to give the same meter reading of 100 volts.

(5) Both S_1 and S_2 are closed.

(6) The phase shifter controls are adjusted to give the smallest possible reading on the V.T.V.M.

(7) This reading is taken, and if the initial reference level was 100 volts, the final reading in volts represents the percentage of distortion.

From this description several points emerge. In the first place, if neither the amplifier under test, nor the circuits of the distortion meter produce any distortion, then there must be some setting of the phase shift controls that will give zero output from the mixer, for if the inputs to the mixer circuit are equal in amplitude, and opposite in phase, the output must be zero. The second point concerns the need for a phase shifter circuit. The circuits of any amplifier must produce some phase shift, whatever the input frequency. The valves themselves each give a phase shift of something quite close to 180°, but never exactly that. This is due to the fact that coupling circuits always give a slightly leading phase angle at low frequencies, while unavoidable shunt capacities give a lagging phase angle at high frequencies. Thus, according to the frequency that is used for the distortion measurement, there will be some phase shift over and above the multiple of 180° that is caused by the valves. However, as long as the controls on the phase shifter enable the phase of the voltage to In_1 on the mixer circuit to be give any desired value from 0 to 360°, it will be possible to find a setting at which the fundamental frequency can be cancelled out.

Now the presence of distortion does not make any difference at all to this cancelling process, as long as the distortion occurs only in the amplifier under test, and not in the remaining circuits as well. A distorted signal consists of the fundamental, undistorted sine-wave, to which have been added small quantities of its harmonics, or frequencies of twice, three times, four times, etc., the fundamental. Even if these additional frequencies are present, it is still possible to cancel the fundamental, leaving only the distortion products.

Another important, but not quite so obvious, point is that within limits, the signal does not need to be an absolutely pure sine-wave. For really accurate work, a pure signal source is essential, because the phase shifter will not shift the phase of any harmonics in the oscillator output by the same amount as it shifts the fundamental. Thus, although it will still be possible to cancel out the fundamental, if the oscillator contains harmonics, the oscillator harmonics will not cancel out, and will be charged against the amplifier under test. It is obviously necessary for the oscillator to be as free of harmonics as possible, but unless very small amounts of distortion are to be measured, traces of distortion in the oscillator will make no noticeable difference to the result. For comparative purposes, for instance, where the distortion meter is to be used only as a means of deciding whether changes in the equipment being tested have made it better or worse, the presence of distortion in the oscillator will only show up as a minimum attainable distortion, and will not prevent changes from being observed.

CIRCUIT OF COMPLETE INSTRUMENT

In Fig. 2 we have the circuit of a practical instrument designed along the lines we have been describing. It does not include either the oscillator or the V.T. voltmeter, since these are often available as separate instruments. V_1 is the input valve, and at the same time is part of the phase-shifter circuit. It is a conventional phase-inverter, in which C_1 and R_1 are connected in series between the two outputs. Such a circuit enables phase shifts of between 30° and 150° to be obtained with almost no change in output voltage, which is a feature that makes it quite easy to carry out the measurements. In this case, there is a reversing switching between the valve and the CR circuit, and this enables a 180° shift to be used in addition to the variable portion, so that almost the whole 360° can be covered by the switch and the potentiometer. S_1 has been arranged so that it short-circuits to earth the grid of the mixer that is not being used during the setting-up process, at the same time as it disconnects the input. This is to prevent any input getting in when it is not meant to, owing to stray capacity coupling to the rest of the circuit.

The mixer circuit consists of two triodes acting as cathode-followers, with a common load resistor. This arrangement is an excellent one from several points of view. In the first place, it is almost entirely free from distortion, up to the point at which the negative half-cycle starts to cut off the valve. The available output voltage is low, but this does not matter, since the mixer is followed by a high-gain amplifier stage, which requires only a very small input signal in any case. Secondly, it enables direct coupling to the amplifier stage to be used, which is a good thing in that it not only eliminates two components, but also removes one RC coupling circuit, which would cause some alteration in the shape of the composite harmonic waveform. Under some circumstances, this does not matter at all, but phase shift here can change the reading of the indicating meter unless it is of the full-wave square-law type. In the plates of the mixer valve, load resistors have been inserted which enable an oscilloscope to be attached to the circuit for examining either the amplifier output or the original oscillator waveform without disturbing the conditions in the measuring circuit.

The amplifier stage is quite conventional, and calls for little comment except for its biasing arrangements. Because the grid is directly connected to the cathode of the mixer circuit, there is a positive potential of about 6 to 7½ volts on the grid of the amplifier valve. The cathode bias must therefore counteract this, and provide the 1½ to 2 volts extra that are needed so that there may be a net negative grid bias of this amount on the valve. This, then, is the reason for the abnormally large cathode resistor in this stage.

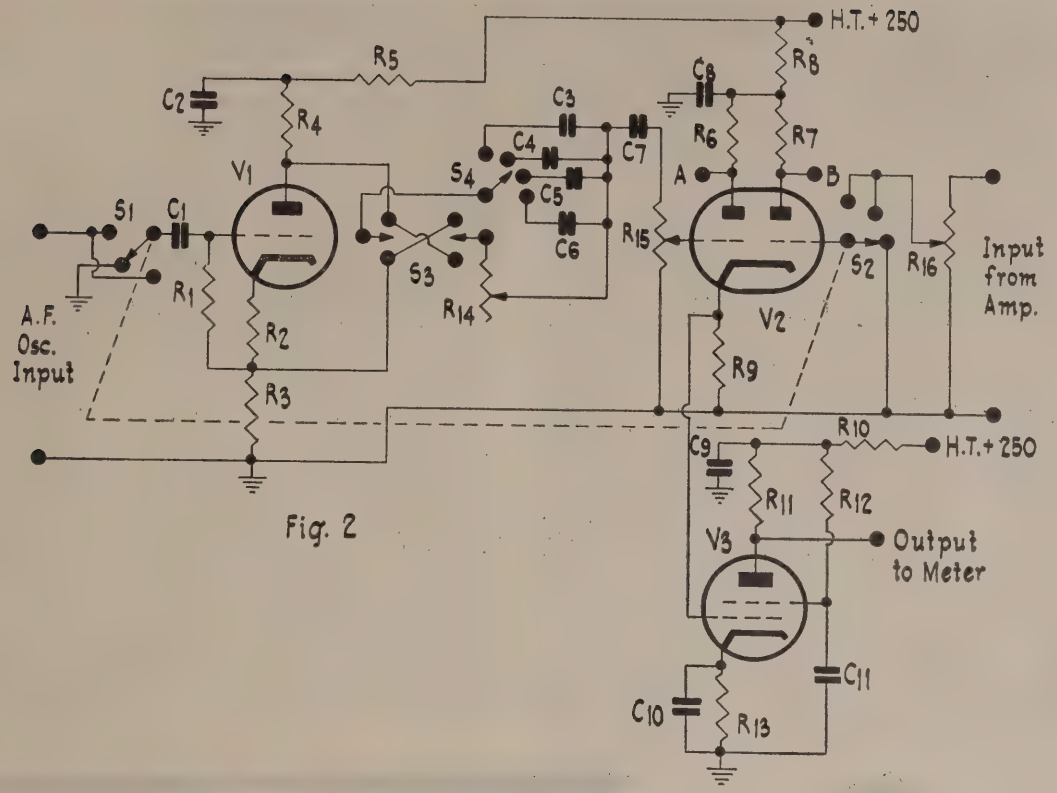


Fig. 2

COMPONENT LIST

R_1, 500k.
R_2, R_9, 2k.
R_3, R_4, 15k.
R_5, R_6, R_7, R_8, R_{10}, 10k.
R_{11}, 250k.
R_{12}, 120k.
R_{13}, 7.5k.
R_{14}, 50k. variable.
R_{15}, 500k. pot.
R_{16}, 500k. pot.
V_1, 6C5.
V_2, 6SN7.
V_3, EF37A.
C_1, C_7, 0.05μf.
C_2, C_8, C_9, 8μf. 450v. electro.
C_3, 500 $\mu\mu$f.
C_4, 0*0025 μf.
C_5, 0.01 μf.
C_6, 0.05 μf.
C_{10}, 25 μf. 25v. electro.
C_{11}, 0.25 μf.
S_1, S_2, single-pole, 3-position, ganged.
S_3, D.P.T.D.
S_4, S.P. 4-position.

SOME FURTHER POINTS ABOUT THE SYSTEM

If you are thinking of building up this device to use in your audio work, it is only fair to point out some of the limitations of the method. Most of them can be overcome, and in a commercial instrument they would add considerably to the expense and complication. But for an amateur instrument, where extreme accuracy is not needed, the additional features can easily be done without.

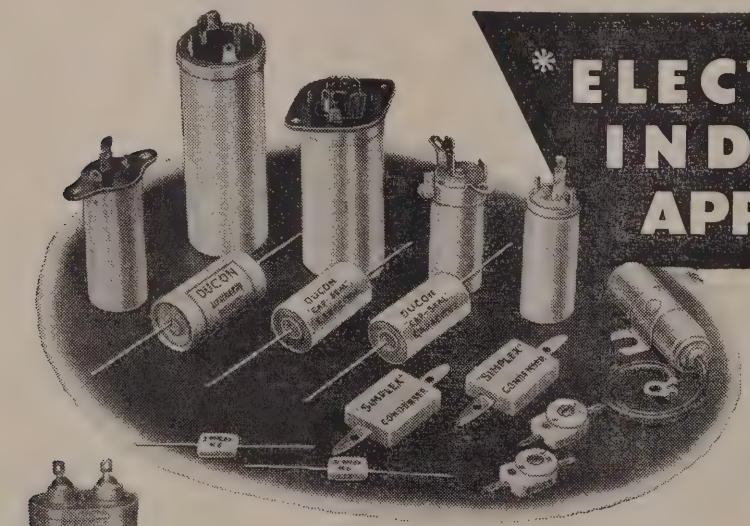
The first and most important point concerns the type of indicating meter used. It might be thought that any sort of vacuum tube voltmeter might be used without making any difference to the results, but this is not necessarily true at all. The trouble is that practically all V.T. voltmeters give a correct indication only on the assumption that they are measuring a pure sine-wave. When we take the remaining distortion products after removing the fundamental, the resulting waveform can be anything but sinusoidal, so that the reading obtained will depend not only on the total quantity of harmonics, but on the type of voltmeter circuit used. In any one instrument, of course, the type of voltmeter will remain the same at all times, but even so, quite large errors can be caused. The only type of voltmeter that does not affect the readings obtained under different conditions is that known as the full-wave square-law meter. This uses one triode, or a pair of triodes, under rather special biasing conditions, such that the meter reading is at all times proportional to the square of the R.M.S. input voltage. This is the only voltmeter circuit that will give the same reading on voltages of the same R.M.S. value, but of different waveform.

How does this affect the distortion meter? As mentioned above, the voltage to be measured is not a sine-wave by any means, if it contains two or more components, as it is frequently likely to do. Suppose, for instance, that there is second harmonic distortion of 3 per cent., combined with 4 per cent. of third harmonic. If this composite waveform is examined on the oscilloscope, it will be found that its shape depends not only on the quantities of the two components, but on their relative phase. If their relative phases are varied, the

composite waveform takes on a wide variety of shapes, and the point at issue is this: these differing wave shapes will all give different readings on any kind of V.T. voltmeter except the full-wave square-law type, which will give the same reading on all of them, and therefore irrespective of the phases of the harmonics. As one illustration, take the peaking-reading diode voltmeter, which is probably one of the most widely used in measuring circuits. This circuit can give out information about only one half-cycle of the input voltage—the half-cycle on whose peak the diode conducts. It does not matter what has happened to the shape of the other half-cycle; all the peak-reading meter can do is to indicate the peak value of one half-cycle. If a non-sinusoidal waveform is fed to the peak-reading diode circuit, the latter will read, but on another waveform, which contains exactly the same components, in exactly the same proportions, it may read something that differs from the first indication by as much as 100 per cent.! It is obvious from this, that the reading of the distortion meter cannot be entirely consistent unless the square-law meter, with its reading that is independent of wave shape, is used. However, the situation is not quite as bad as it seems. In general, we hope, we are measuring small amounts of distortion which contain mostly one harmonic only. For example, in a properly constituted push-pull amplifier, we would not expect there to be more than a very little second harmonic, since most of this should have been cancelled out by the push-pull circuit arrangement. We therefore expect the distortion near the overload point to be almost entirely third harmonic. If this is so, the distortion waveform will be very nearly a sine-wave, and our objections to the ordinary types of voltmeter circuit largely disappear. Indeed, since one harmonic usually predominates, and is mixed with only small quantities of other harmonics, the square-law indicating meter is strictly necessary only for precision work. It is, however, necessary to know what the requirements are, should one be interested in anything much better than the simple arrangement described here.

Another thing that will probably have occurred to readers is the existence of hum in the amplifier under test, or in the circuits of the distortion meter, or both. The hum in the latter should be very small, but since there is one high-gain stage, this hum might still be large enough to show on the output meter unless the ordinary precautions against it are taken. But in the case of hum belonging to the amplifier under test, we are in a different position. This hum will get through to the measuring circuit, and will be accounted for as distortion. It is certainly undesirable, and should be eliminated from amplifiers as far as possible, but it does not come in quite the same category as harmonic distortion, and so it is hardly right to read it as part of the distortion of the amplifier. It can give an entirely wrong idea of the actual distortion present, even if this is very small, and if the hum, too, is very slight. For example, the hum might be at a level that can be tolerated, and so is insufficient to cause us to do anything about it, but should the distortion also be very small, the presence of the hum could easily cause the distortion to be measured as twice as great as it really is. One cure for this would be to insert a high-pass filter into the measuring circuit, cutting off just above 100 cycles per second. In this way, the hum would be prevented from reaching the meter and from modifying the results. Here again we have an effect that need not be worried about unless

(Concluded on Page 48.)



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BOOK REVIEWS

A.M.I.E.E. Publishers, Messrs. Iliffe and Sons, London.

This little book, according to the author's introduction, "is intended for all those who have to do with the actual process of (interference) suppression, from design engineers, who, in developing new equipment, are called upon to ensure that it will be interference-free, to service engineers in the field who have to cope with specific causes of interference." It is divided into seven chapters, covering sources of interference, their location, the principles of suppression and their practical application to specific problems, and finally, suppression at the receiver of interference that must be accepted under the circumstances. There are also appendices covering the measurement of interference, the provisions of the latest British Wireless Telegraphy Act in respect to interference, screened rooms, and British stands relating to interference.

It can be seen from the above, that the subject has been covered quite comprehensively. What does not appear from this simple list, however, is that the material includes information on the suppression of interference in television receivers, which have their own peculiar problems, both from the suppression and generation points of view. The book is mainly concerned, and rightly so, it is considered, with the exposition of principles rather than the citation of innumerable special cases and their solutions. As the author says, the suppression of interference is as much an art as a science, and some of the qualities of the story-book detective are highly desirable in one whose job it is to track down and cure specific causes of interference.

On page 12, there is what appears to be a rather startling error in fact. When, in dealing with the analysis of complex waveforms, the author attributes to de Moivre the discovery that any recurrent wave can be compounded from a fundamental sine-wave and some or all of its harmonics. The writer of this review has always been under the impression that Fourier was responsible for this discovery, and it would be interesting indeed to find that Mr. Stephens is correct in attributing it to de Moivre. However, this small apparent error has no harmful effect on the sense of the text, particularly since the book contains no mathematics whatever The author is to be congratulated on having collected together in one place a great deal of practically useful information on a very poorly documented subject. Interference is something which must assume ever-increasing importance to all those engaged in the radio industry, and this book should fill admirably the need for a simple, practical text on the subject.

Sound Recording and Reproduction, by J. W. Godfrey and S. W. Amos, B.Sc., A.M.I.E.E. Publishers, Messrs. Iliffe and Sons, London.

This new book should be welcomed by those who have felt the lack of a comprehensive treatise on sound recording. It is probably the only book of its kind that is not largely obsolete, and the treatment is full without being unduly mathematical. Indeed, most of the mathematics included are reserved for the several excellent appendices, so that anyone who wants to learn the salient facts about recording, and how to do it, can tackle the book very readily, and with much interest, irrespective of their mathematical equipment. The authors get off to a good start wtih an excellent first chapter which is largely historical in nature, but which also contains a number of definitions. These are rather important in view of the lack of standard definitions of many of the phenomena and quantities that are commonly used in audio engineering. The establishment of such definitions leaves the reader in no doubt as to the authors' precise meaning when some of the more indeterminate terms are used in the text.

The matter dealing with the principles of disc recording is exceedingly well presented, all the numerous parameters which can affect the final result being fully discussed, as well as the basis on which these parameters are chosen to form a given recording system. This chapter would be well worth while paying the whole price of the book for, since such a comprehensive treatment of the factors involved has seldom, if ever, been seen before. The same cannot be said for the chapter on magnetic recording, however. The chapter on this increasingly important development occupies only 20 pages in a book of over 250 pages. Of these 20 pages, three pages are devoted to a very brief account of the E.M.I. professional tape recorder, and five pages to the principles of modern supersonic bias technique. The remainder of the space given to magnetic recording is given over to descriptions of the earlier and now obsolete Marconi-Stille equipment and to a very short résumé of principles. One could have expected, not unreasonably, that considerably more space could have been devoted to magnetic recording, and to the modern method in particular. Of course, this would have meant an increase in the size of the book. However, if the treatment of magnetic recording were as comprehensive as that of disc recording, this would have been even more valuable an addition to the literature than it is.

The appendices are excellent, and are devoted to important aspects of disc recording. They deal with such things as the manufacture of sapphire-tipped recording cutters, the various types of electric motor that are used in recorders and playback mechanisms, electro-mechanical analogies, tracking error in pick-ups, and distortions due to the mechanical systems used, including turntable "wow." All these things are given very worth-while treatment, and from the point of view of those whose main interest is disc recording and reproduction, are very valuable additions to the main text.

All told, this book should find wide acceptance among technicians and engineers, and it is hoped that at no too distant date the publishers can see their way to commissioning an amplified edition, which will give as adequate treatment to magnetic and sound-on-film recording as the present one does to disc recording.

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TUBE DATA: THE EB41 DOUBLE DIODE

In detector circuits, such as the Foster-Seely circuit and the more recent ratio detector, where frequency variations are transformed into amplitude variations, a double diode is required for the detection. This double diode should have entirely separate sections and low internal resistances.

The EB41 is a double diode with separate cathodes and low internal resistances, rendering it specially suitable for circuits operating with low load impedances. Between the anodes a screen has been incorporated which keeps the capacitance between the electrodes low.

Apart from the use of the EB41 in a ratio-detector or a Foster-Seely circuit one diode section may also be used to provide additional limiting in an F.M. receiver, the other section then remaining for such purposes as automatic gain control. In such a limiter circuit the diode is connected across the secondary of an I.F. transformer, the diode load being formed by a resistor of such a value that the Q of the transformer secondary is almost entirely determined by the diode damping. This load resistor is shunted by a large capacitor so as to prevent A.C. voltages from being developed across the load. As a result the damping of the I.F. transformer secondary increases and decreases with the amplitude of the I.F. voltage, so that this is kept more or less constant. If a load resistor of 10 kΩ is used with one section of the EB41 the diode damping under quiescent conditions is about 6.5kΩ. With a critically-coupled I.F. transformer having circuit Q's of 80 and tuning capacitances of 50 pF the modulation of the I.F. voltage is reduced by a factor of about 3.2 when the I.F. signal at the diode is 2v. R.M.S., this reduction factor gradually increasing to about 4 with an I.F. signal of 10v. R.M.S.

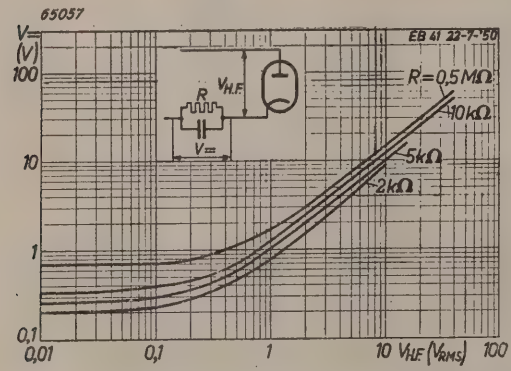


Fig. 2.—D.C. voltage developed at the load of an EB41 as a function of the R.M.S. value of the H.F. input voltage for different values of the load resistor.

TECHNICAL DATA

Heater Data

Heating: Indirect by A.C. or D.C.; parallel supply.

Heater voltage	V_f	6.3 V
Heater current	I_f	0.3 A

Mounting Position: Any

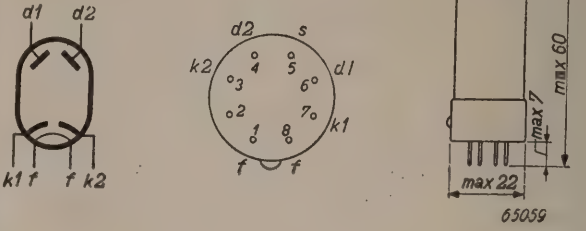
Capacitances:

Between anode and cathode of section 1	C_{da1}	3.5 pF
Between anode and cathode of section 2	C_{da2}	3.5 pF
Between anodes	C_{a1a2}	<0.03 pF

Limiting values (per section):

Anode voltage (inverse peak)	V_a	max. 430 V

BASE CONNECTIONS AND DIMENSIONS IN mm



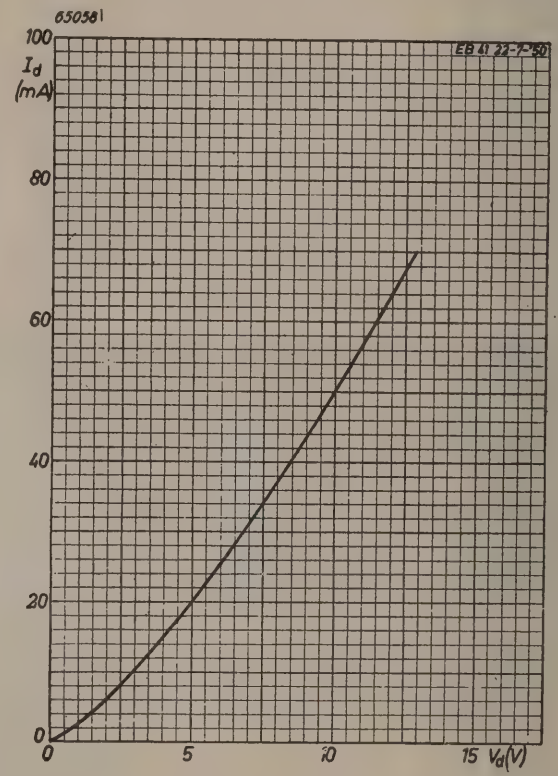


Fig. 3.—Anode current of the EB41 as a function of the anode voltage.

Average anode current	I_a	max.	9 mA
Peak anode current	I_{ao}	max.	54 mA
Anode current starting point ($I_a = +0.3\ \mu A$)	V_a	max.	−1.3 V
Voltage between heater and cathode	V_{kf}	max.	150 V
Peak voltage between heater and cathode (cathode positive with respect to heater)	V_{kfp}	max.	330 V

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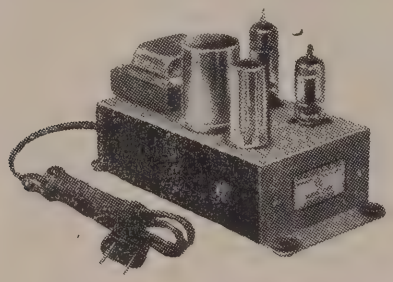

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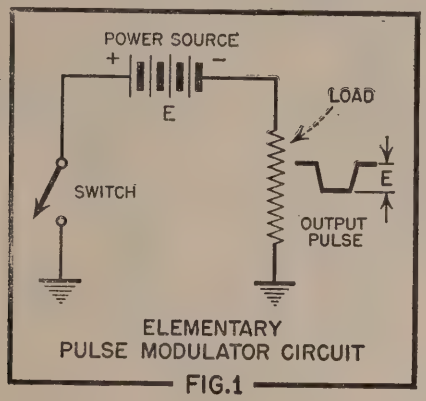
Introduction to Radar Techniques

Part III.—The Pulse Modulator

By the Engineering Department, Aerovox Corporation

This series of articles is devoted to a discussion of the specialized components which comprise the basic radar system. Part I consisted of a description of the overall equipment used for radio detection and ranging while Part II dealt with the principles of the magnetron transmitting tube. The present article discusses the means employed to generate the high voltage D.C. pulses which are applied to the magnetron. This equipment is variously known as the "pulse modulator," "pulser," or "keyer."



ELEMENTARY PULSE MODULATOR CIRCUIT

FIG. 1

The techniques used in this equipment to generate pulses which may be as much as 60 kilovolts in peak amplitude and yet only one-millionth of a second in duration are typical of radar practices, and so are of interest here.

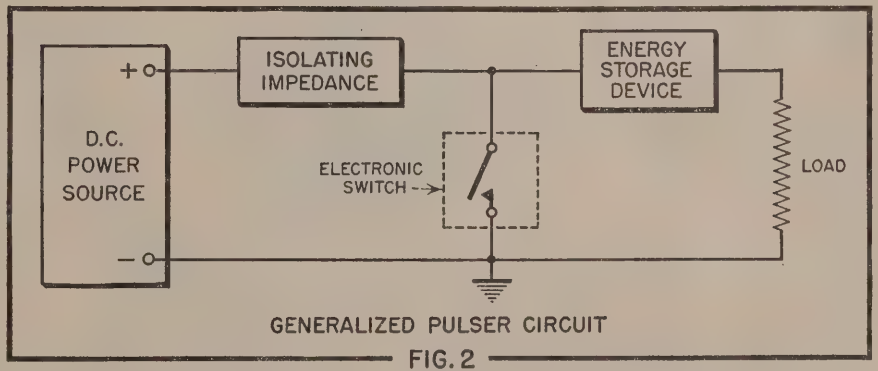
The basic function of the modulator in a radar set can be illustrated by the elementary circuit of Fig. 1. In this circuit, a source of E.M.F., such as a battery is periodically connected to the load circuit for short intervals by a switch or key. The pulse of voltage which appears across the load circuit will be essentially rectangular if the distributed inductance and capacitance of the circuit is low and this pulse will have a duration equal to the time the switch is closed. For reasons explained in Part II, most radar modulators are designed to give a negative pulse.

In actual practice, the circuit of Fig. 1 is not practical because of the high internal impedance of the battery or other power supply and the difficulty of forming very short pulses mechanically. For these reasons, the circuit is usually modified as in Fig. 2. Here the energy from a D.C. power supply is used to charge a storage device such as a capacitor or *pulse network*. This stored energy is then recurrently connected to the magnetron load circuit for short intervals of time by an electronic switching device. This switching device may take the form of a high vacuum tube or a gas thyratron. Which form of switch tube is used determines the general category into which any particular modulator design falls. Since the characteristics of these two types differ considerably, they will be considered separately.

THE "HARD TUBE" MODULATOR

Any form of pulser or modulator which utilizes high vacuum tubes for the function of switching the high pulse currents required by the magnetron is classed as a "hard tube" modulator. The simplified circuit of a pulser of this type is shown in Fig. 3. In this type, the grid of the vacuum tube, which is normally biased to cut-off, is driven positive by a pulse from a "driver" circuit. The storage device is thus connected to the load circuit for the duration of the positive driver pulse, and a negative pulse appears across the load. The storage device is usually a large capacitor which is capable of supplying the energy needed by the load during the pulse with only a small drop in voltage. This voltage drop is frequently only a few percent.

The storage capacitor recharges from the D.C. source in the interval between pulses. This *interpulse interval* is usually very long compared with the duration of the pulses. This makes it possible to isolate the D.C. recharging circuit (shown in light lines in Fig. 3)

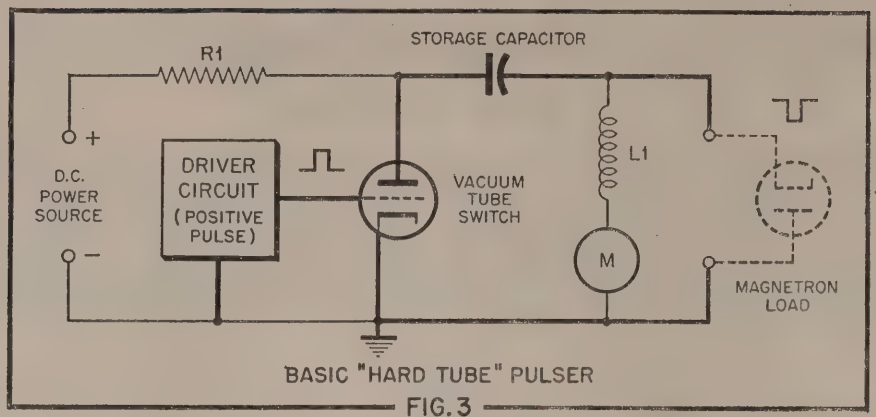


GENERALIZED PULSER CIRCUIT

FIG. 2

from the pulse circuit (heavy lines) during the pulses by means of isolating elements such as L_1 and R_1, which have very high impedances for short pulses. The average current drawn by the magnetron is measured by the meter (M) indirectly, since this meter indicates the current from the D.C. source required to replenish the charge on the storage condenser. This current is equal to the magnetron average current since the condenser discharges only through the magnetron.

The tube or tubes in the output stage of a hard tube modulator must be capable of withstanding an anode voltage equal to the voltage of the required output pulses. They must also be capable of conducting the peak pulse current required by the magnetron. In radar practice, large transmitting-type triodes or tetrodes are usually

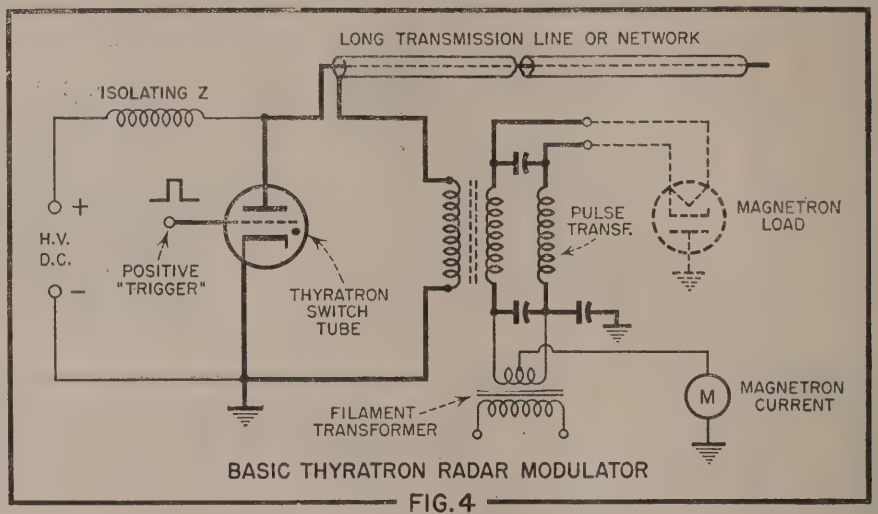


BASIC "HARD TUBE" PULSER

FIG. 3

Since the grid of the thyratron is incapable of interrupting the plate current at the end of the driver pulse, the storage device must be of a type which discharges entirely during each pulse. Otherwise, the gas in the thyratron would remain ionized as long as a voltage existed across the tube. A small capacitor like that used for energy storage in the hard tube modulator cannot be employed, since the discharge pulse would be exponential in shape rather than rectangular. However, if a length of open-circuited transmission line is charged to a high voltage and suddenly connected to a load impedance equal to its characteristic impedance, an essentially rectangular current pulse flows through the load. The duration of the pulse so formed is equal to twice the time required for an electrical impulse to travel the length of the line. This time is determined by the *propagation constant* for the type of transmission line used. In actual practice, the transmission line is usually replaced by an *artificial line* made up of lumped inductances and capacitors for all but very short pulses. This is because an actual line is inconveniently long for the pulse length most frequently employed, whereas the simulated delay line, or *pulse forming network* as it is sometimes called, is quite compact even for 10 microsecond pulses. Fig. 5 shows one of the possible connections for a pulse network and some of the design constants involved.

The pulse forming network will deliver maximum energy to the magnetron only if its impedance matches that of the magnetron. Since the usual magnetron impedance is between 500 and 1,000 ohms, while the design of the pulse line is most practical for low impedances of 25 or 50 ohms, an impedance matching device must be used between the line and the load. This requirement has led to the development of the *pulse transformer*,



BASIC THYRATRON RADAR MODULATOR

FIG. 4

employed. Types having tungsten or thoriated-tungsten filaments are the most practical for this application because the high voltages involved make the use of oxide-coated emitters somewhat marginal. The pulser tubes are usually biased to cut-off or beyond, so that plate current flows only during pulses.

The driver circuit used to drive the modulator tubes to conduction during pulses may be one of several types. In one system the rectangular pulses are formed at low level by a small gas tube or blocking oscillator and amplified to the required driving level by several hard tube stages biased to cut-off. another method utilizes a medium power hard tube in a special blocking oscillator circuit to form the drived pulses. A third approach makes use of a small thyratron pulser, of the type to be discussed later, to drive the hard tube final stage. In any of these driver systems, the pulse repetition rate is determined by a "trigger" pulse which is introduced into the first driver stage to insure that the transmitter pulse is synchronized with the range sweep on the oscilloscope. This synchronizing pulse is usually generated in the display section of the radar system.

THE THYRATRON MODULATOR

Radar pulsers which use gas-filled tubes for the purpose of pulse switching are known are "thyratron" or "line type" modulators. The gas most frequently employed is hydrogen. Relatively small tubes are capable of conducting peak pulse currents of hundreds of amperes with small voltage drop. In addition, only a small trigger pulse is required to drive thyratrons to heavy conduction. The thyratron differs from the hard tube, however, in that the grid loses control after conduction has been initiated. This characteristic results in the basic circuit of the thyratron-type modulator differing considerably from that of the vacuum tube modulator, as is illustrated in Fig. 4.

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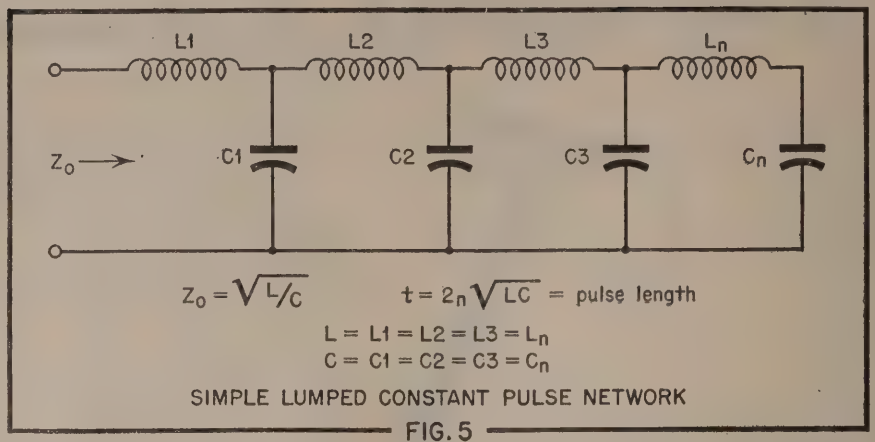
which transforms the impedance of the magnetron load to that of the source. The transformer is specially designed to pass the square pulses. It is carefully designed to minimize leakage inductance while maintaining shunt inductance at a maximum. A special core material having very thin laminations is used to obtain sufficient permeability to pass frequency components up to several megacycles present in pulses having fast rise time. Pulse transformers which faithfully reproduce pulses ranging from a few hundredths of a microsecond to about 10 microseconds are available, although individual designs are satisfactory over a much smaller range. Turns ratios from about 2:1 up to something like 6:1 are practical. The physical appearance of a typical pulse transformer is shown in Fig. 6. As indicated in Fig. 4, the secondary of the transformer is usually *bifilar* wound. This means that the secondary consists of two wires wound as one. This permits the magnetron heater current to be sent through the secondary windings of the pulse transformer from a filament transformer having low voltage insulation. Otherwise, a specially built low capacity filament tranformer, insulated for the full pulse voltage, would be required.



SIMPLE LUMPED CONSTANT PULSE NETWORK

FIG. 5

COMPARISON OF MODULATOR TYPES

Because of the differences in basic circuits, the performances of the two general modulator types differ considerably. Each has certain disadvantages not inherent in the other. The important characteristics may be compared as follows:

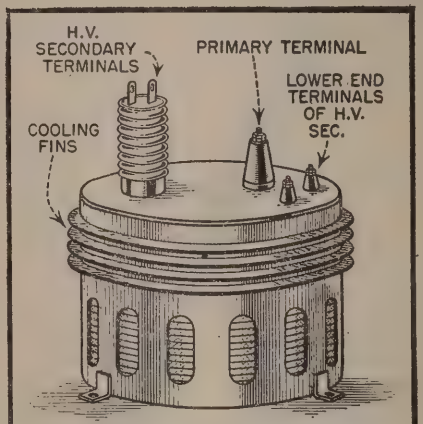
(a) *Efficiency.* The thyratron type is inherently the most efficient. It requires fewer stages and consequently less drain from power source. The voltage drop in the switch tube is less than in the hard tube case, resulting in less power dissipation.

(b) *Impedance Sensitivity.* The hard tube modulator has the advantage in this respect since it can operate fairly efficiently into load impedances varying over a wide range. For good efficiency and satisfactory pulse shape, the line type pulser must match the load impedance to within about ± 30 per cent. Thus, the line modulator has a disadvantage in applications where many magnetron types are encountered, such as laboratory testing.

(c) *Adaptability.* The hard tube modulator is the most adaptable to different pulse durations and repetition rates. Since the pulses are formed at low level small components can be switched for varying pulse durations. In the line pulser the pulse forming network and, in some instances, the pulse transformer, must be changed to effect a change in pulse duration. In addition, the pulse line is usually designed for operation only over a small range of repetition rates.

(d) *Voltage Requirements.* The thyratron modulator requires a lower voltage D.C. supply since the pulse transformer steps the pulse voltage up to the required level. In the hard tube system, the D.C. source must furnish a D.C. voltage equal to the required pulse voltage.

(e) *Arcing Behaviour.* In case of internal magnetron arcing, the hard tube modulator is more severe than the thyratron type since the entire charge of the storage capacitor can discharge through the magnetron, with damaging effects on the magnetron cathode. The energy stored in the pulse forming network, on the other hand, is only the amount required for each pulse.



TYPICAL PULSE TRANSFORMER

FIG. 6

As a result of these characteristics, the thyratron pulser is usually favoured for field radar applications where its greater efficiency, simplicity, and light weight give it the advantage. The hard tube modulator is useful in laboratory applications because of its versatility and in instances where very high repetition rates make the gas tube type inapplicable.

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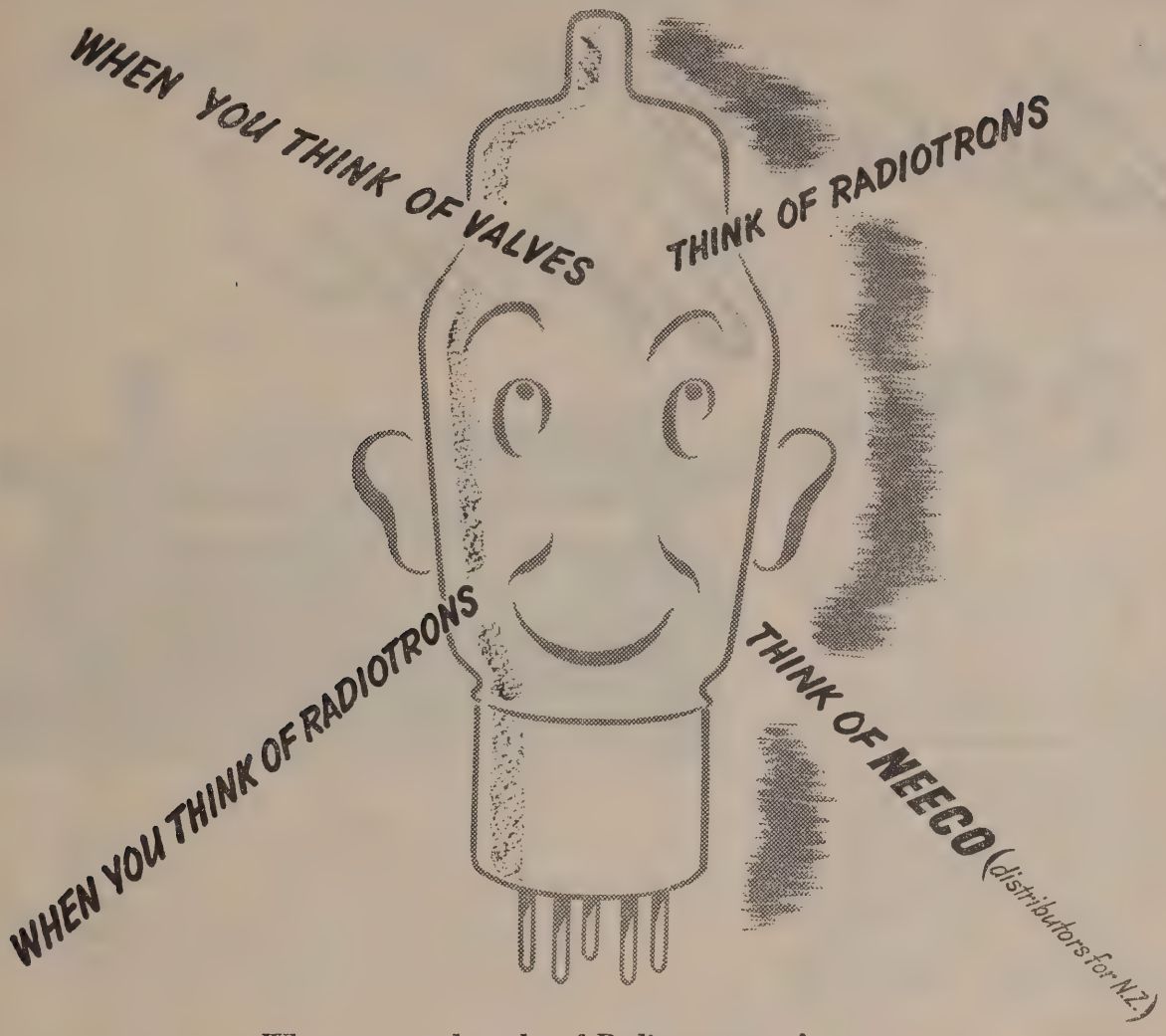

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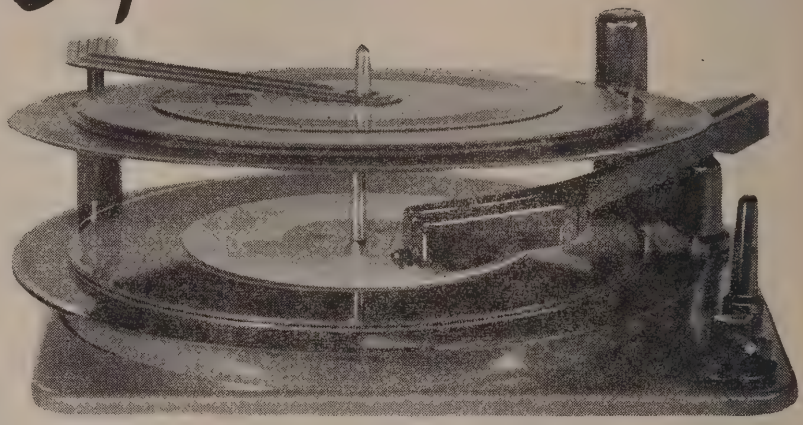

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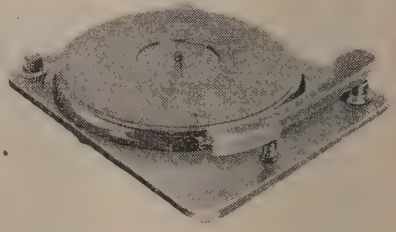

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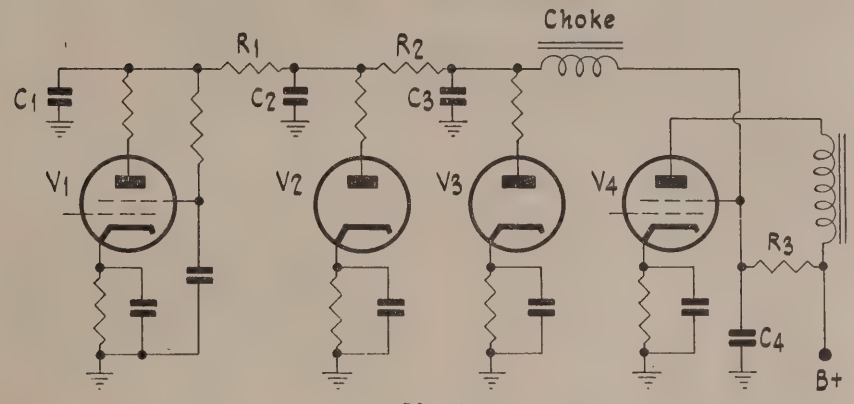

Fig. 1

For the benefit of the uninitiated, decoupling in radio has nothing to do with the duties of a railway shunter, but surprisingly enough, bears a certain resemblance to his work in its final effect. To explain more lucidly, when the engine is decoupled from the carriages it is free to move off on its own without causing a corresponding reaction in the carriages or trucks. So in radio, if one circuit is properly decoupled from another then it does not influence the other circuit in an unwanted manner.

Resistors and condensers are most frequently employed for this purpose, although both iron-cored and air-cored inductances find considerable application.

In high gain audio equipment, good decoupling is of prime importance and many a constructor has come to grief through not providing sufficient decoupling for the job in hand.

Figure 1 shows a basic amplifier of four stages. The first valve could be a microphone pre-amplifier feeding to another straight amplifier and then possibly to another if required and thence to an output stage. V_3 could be made a phase inverter feeding to push-pull output valves but the decoupling would remain the same. In this case the decoupling resistors and condensers are R_1, C_1, R_2, C_2, a choke and C_3, and R_3, C_4. This arrangement is good in that each stage is decoupled from its neighbour and although in practice this may not be necessary to the full extent shown, it is a wise precaution to take, and anyway each additional set of decoupling components assists very materially in hum filtering so that by time the B+ voltage reaches the first valve it possesses the desirable characteristics of steady hum-free high voltage. In the case of push-pull output valves, an advantage is obtained by using a choke to filter the B+ from the screens to the next stage, which is generally the phase inverter. The choke, having low D.C. resistance, permits a high B voltage to be applied to the phase inverter where it is necessary to get large voltage swings to drive the grids of the output valves. Being an iron-cored inductance, however, it offers a high impedance to hum components of the H.T. and ensures a steadier supply than would be obtained with a resistor.

In the case of the twin triode type of valve, it is frequently common practice to join the two cathodes together and use a common bias resistor and condenser. In most cases this is satisfactory enough, but can and does cause interaction between the two tubes, particularly

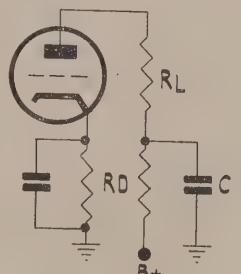

Fig. 2

if after a while the electrolytic bias condenser should dry out and lose capacity. Separate bias resistors and condensers for each cathode are to be preferred.

In Fig. 2 is shown a common arrangement employed in most radio sets around the first audio second detector tube. R_L is the normal plate load of the valve and R_D and C are the decoupling components. Where economy or other factors have decreed that the manufacturer should leave out R_D and C the set frequently has a high inherent hum level. By adding the two missing decoupling parts a great improvement can be brought about. Any radio man who has attempted to get a set going with two stages of I.F. amplification will appreciate the

(Continued on Page 48.)

The PHILIPS Experimenter

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No. 61: Screen Modulation of the QQE06/40—Part II

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In the first part of this Experimenter article, we discussed some of the methods used for screen modulation of R.F. pentode power amplifiers and, in particular, those that have been developed as extensions of the so-called clamp-tube protective device. In this instalment, we present some practical circuits, in which screen modulation methods are applied to the QQE06/40, which tests have shown to be eminently suitable for this type of modulation.

PRACTICAL CIRCUIT FOR "CLAMP-TUBE" MODULATION

This arrangement is illustrated in Fig. 4. It will be seen that the R.F. part of the circuit is quite conventional, being the usual sort of push-pull Class C amplifier arrangement, using grid-leak bias. The load resistor for the Philips EL41 modulator valve is 30k., while the additional screen dropping resistor of 10k. is bypassed for audio frequencies by a 2 μf. condenser. Incidentally, this need not be a highly rated component, since it has only a small A.F. and D.C. voltage across it; 350-volt rating should be sufficient. One point to note about the circuit is the presence of 100-ohm plate stopper resistors. Although the trouble was not encountered with the original Philips transmitter, which was perfectly stable without them, the experimental circuit that was built up in order to try the screen modulation circuits suffered from a most persistent low-frequency parasitic until these stopper resistors were inserted. The complaint, as well as the cure, is most unusual, and at first it was thought to be due to the fact that the original circuit had shunt-feed in both grid and plate circuits. This system gives trouble with low-frequency parasitics, owing to the self-resonant frequencies of the grid and plate chokes being the same, and can often be cured by altering one of the chokes. Removing one of them altogether, and using shunt feed only on one side of the amplifier is usually a certain cure, but in this case it did not work, and only the plate stoppers were of any assistance. It seems possible that the oscillation was actually a V.H.F. one, which was squegging at some low frequency at the same time; if this were so, it would explain the otherwise rather mystifying behaviour.

The EL41 is cathode biased, and triode-connected, and can be mounted as close as may be convenient, to the socket of the QQE06/40, so that the leads to the screen circuit are as short as possible. It is essential to keep R.F. out of the modulator grid circuit, since it can easily overload the modulator tube should it get in, and cause severe distortion. Besides, R.F. in the modulator tube could possibly cause the amplifier stage to go into oscillation, although this is not very likely, in view of the built-in screen bypass condenser of the QQE06/40. However, an effective R.F. choke in series with the grid lead of the modulator was found quite effective in preventing R.F. feed-through. The audio output of the modulator was examined on an oscilloscope after the choke had been inserted, and it was found that R.F. was notably absent.

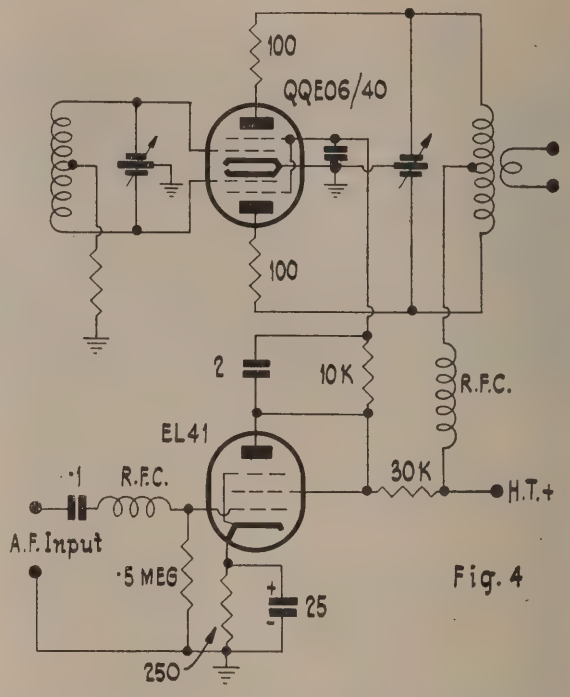

Fig. 4

It was mentioned earlier that when any Class C stage is screen modulated, the maximum carrier power is only a quarter of that which can be used with plate modulation. The reason for this is not hard to find. Screen modulation varies the efficiency of the Class C stage, so that at maximum output, which occurs at 100 per cent. modulation, the stage must be working at its greatest efficiency. Then, in order that maximum output may actually be obtained at 100 per cent. modulation, the output, and therefore the efficiency, at zero modulation, must be reduced. Since the carrier voltage, unmodulated, is exactly one-half the peak R.F. voltage at 100 per cent. modulation, the screen voltage must be reduced until the carrier voltage is just half the carrier voltage that can be obtained with full voltage on the screen. And since the carrier power is proportional to the square of the carrier voltage, the carrier power for the screen-

modulated condition must be a quarter of the C.W. carrier power.

To illustrate the sort of performance that can be obtained, the following figures will be found interesting:

	C.W. conditions	Screen-mod. conditions
Plate volts	800	800
Plate current	74 ma.	80 ma.
Screen voltage	145	145
Screen current	2.5 ma.	6 ma.
Grid current	2 ma.	2 ma.
Grid leak resistance	35 k.	35 k.
Modulator plate current	16.5 ma.	12 ma.
Modulation percentage	0	85 %
Power output	17.6 watts	27.6 watts

There are several things about this table that are of interest. In the first place, it will be noted that the plate current has not been held constant, as theoretical considerations indicate it should be. Lower down the list, we see that the carrier power was 17.6 watts, while the power output at 85 per cent. modulation was 27.6 watts. Now if the carrier power remains constant during modulation, the measured power output at 100 per cent. modulation should be 50 per cent. greater than the carrier power without modulation. The above figures show that at only 85 per cent. modulation, the output power is 57 per cent. greater. Under ideal conditions, the power output at 85 per cent. modulation should be 1.36 times the carrier power at no modulation, as against the 1.57 times actually found. From these figures it can be calculated that the carrier power at 85 per cent. modulation is actually 20.3 watts. This increase of carrier power means simply that the modulation obtained is not linear, so that some distortion must be present. However, as long as the quantity is not excessive for speech transmission, such an increase in carrier power under modulation cannot be regarded as a drawback. Indeed, it is equivalent to a small amount of "controlled carrier" effect, and will be beneficial rather than detrimental.

A second point is that the QQE06/40 is obviously being used at a plate voltage considerably higher than the normal rated maximum, while the plate current, and therefore the power input, are still much less than the maximum ratings. For amateur work, however, there should be no disadvantage in this type of operation as long as the plate dissipation is not exceeded at the same time as the plate voltage rating. Under the experimental conditions outlined in the table above, it will be noted that at no modulation, the plate dissipation is 41.6 watts, while at full modulation the plate dissipation is only 36.4 watts, which is well within the ratings. It is recommended, however, that for this type of modulation, the plate voltage should be kept no higher than 750 volts, under which conditions the input and output will be within 95 per cent. of the figures quoted in the table.

ADJUSTMENT OF THE CIRCUIT

In adjusting a stage such as this, the main thing to remember is that we are NOT adjusting it for maximum power output. In order to achieve as linear modulation as possible, the conditions in the circuit need fairly careful adjustment. We have control over the grid drive and the plate loading, and with a given circuit, these can easily be varied until the best operating conditions are found. The adjustment is best done with an oscilloscope in the first instance, but if, as here, the required grid drive has been determined in advance, this leaves only the loading to adjust if things are to be got going properly. There is no good purpose to be served by driving the grids harder than indicated. If this is done, the power output under no-modulation conditions is increased, but it becomes impossible to approach 100 per cent. modulation without the positive peaks flattening off after about 30 per cent. has been reached. Similarly, the loading on the output tank should be adjusted until the

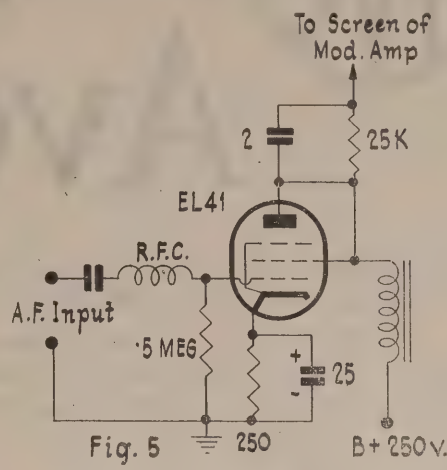

Fig. 5

specified input current, or something close to it, is reached. As with the grid drive, it will be found that there is an optimum degree of output coupling, anything less giving smaller power (input and output) and anything greater resulting in decreased linearity of modulation.

If a 'scope is not available, a dummy load, an absorption wavemeter type of phone monitor, and an audio oscillator or gramophone record will be needed. With the grid current set to 2 ma., the loading on the output tank

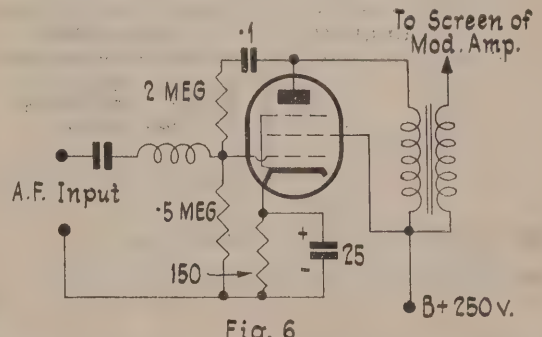

Fig. 6

is increased until the required plate current is reached with no modulation, and modulation is finally applied. The monitor is used to indicate what the maximum audio input to the modulator should be, and quite an accurate idea may be had by listening carefully for the point where serious distortion sets in. If the remaining conditions are as recommended, it will be found that between 80 and 90 per cent. modulation will be reached before this happens, although with a 'scope or a modulation indicator this cannot be measured.

A CIRCUIT FOR SEPARATE SCREEN SUPPLY

In Fig. 5 is shown a circuit which can be used where it is desired to use a low-voltage supply for the screen-

(Concluded on Page 48.)

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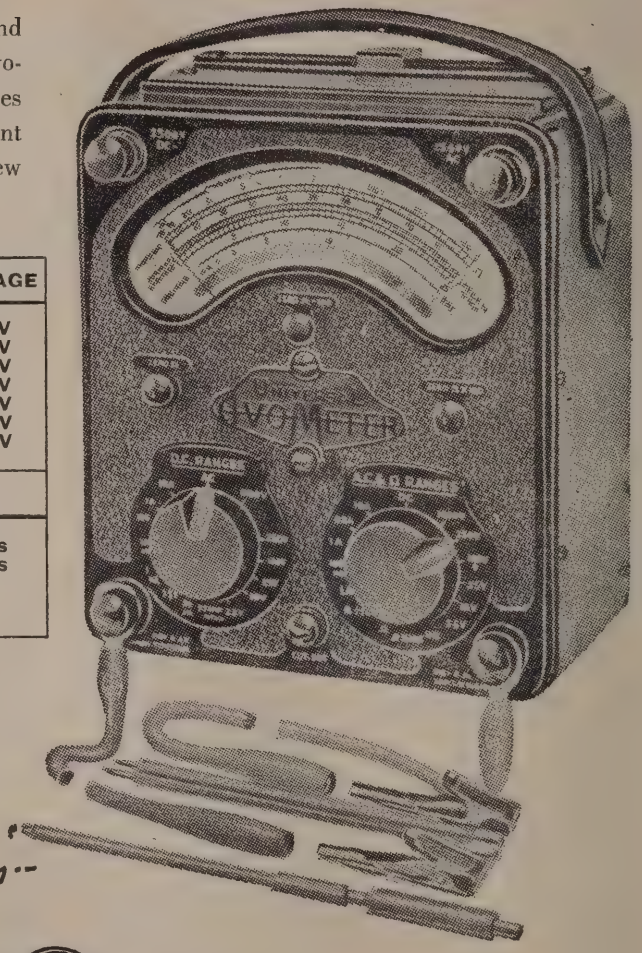
250 V	100 mA	250 V
100 V	10 mA	100 V
25 V	1 mA	25 V
10 V	250 mA	10 V
2.5 V	50 mA	2.5 V

A.C. CURRENT	RESISTANCE
10 A	0—200 Megohms
2.5 A	0—20 Megohms
1 A	0—2000 Ohms
100 mA	



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The "RADIO and ELECTRONICS" Abstract Service

ANTENNAE AND TRANSMISSION LINES

Our knowledge of the dipole for short-wave extends for a quarter of a century, but each physicist proceeds on the basis of acceptable compromises. This article explains simply dipole characteristics, matching a dipole to a feeder, folded dipoles, images due to mismatching, bandwidth, and directional aerials.
—*Wireless World* (Eng.), June, 1952, p. 213.

A phase-angle detector for R.F. transmission lines. To get a low-pass filter working in the output circuit of a transmitter, the filter must be inserted in a line that is "flat." The principle used is the Foster-Seeley discriminator but the circuit of the phase-angle detector is untuned, so that it is phase conscious.
—*QST* (U.S.A.), July, 1952, p. 17.

A simple explanation of the fundamentals involved in getting the most out of an antenna. The article gives the novice what he needs to know to solve his coupling problems. The single wire antenna, the Zepp antenna, and the centre-fed antenna; also the coupling to the antenna system.
—*Ibid*, p. 1952.

AUDIO EQUIPMENT AND DESIGN

"Boundary-Displacement" Magnetic Recording. In conventional recording systems the magnetization characteristics of the material is involved in the modulation process, and high frequency "bias" must be applied to reduce non-linearity arising from this source to practical limits. There is, however, "boundary displacement recording" which can be used with standard commercial tapes. The principle requires a high degree of accuracy and it is an open question whether there will be much advantage in the proposed method.
Wireless World (Eng.) June, 1952, p. 218.

Universal design curves for tone control circuits. The articles describe simple circuit arrangements suitable for particular types of tone control and include frequency-response curves obtained with each circuit. The curves permit rapid evaluation of the ability of the circuit to fulfil specific design requirements and other factors.
—*Radio and Television News* (U.S.A.), August, 1952, p. 42.

ELECTRONIC DEVICES

Those concerned with photography will be interested in two articles on the "electro-flash." Circuits for the flashes are given and would be interesting to build, and a circuit which provides high and low light output.
—*Radio and Hobbies* (Aust.), August and Sept., 1952.

A constant current D.C. amplifier. Design reduces power-supply requirements because the amplifier does not present varying load as do conventional circuits. Costs are cut by using only one high-voltage winding, one rectifier tube, and minimum filtering components.
—*Electronics* (U.S.A.), July, 1952, p. 130.

Ultrasonic sound, since it is a form of mechanical energy, may be employed to investigate tissue properties. Equipment showing increased echo amplitude from cancerous tissue has been used for cancer diagnosis. Frequencies in the megacycle range are necessary to keep wavelength short and the crystals radiate into water to couple to the tissue concerned.
—*Ibid*, p. 136.

INSTRUMENTS AND TEST GEAR

Damage due to overload of microammeters and sensitive current instruments can be prevented by use of an electronic monitor circuit. A thyratron operated relay opens the load circuit when the voltage across the meter exceeds a predetermined value. In order that the relay may open fast enough the relay is normally non-energized until overload occurs and by overdriving the relay fast operation is obtained.
—*Electronics* (U.S.A.), July, 1952, p. 143.

Experimenters often need a D.C. and filament power source for experimental circuits and in addition a signal of particular waveshape. On a small chassis the power supply is mounted, with a sine-wave cycle, which may be used for filaments, and gives also a square-wave signal and a saw-tooth signal.
—*Radio and Television News* (U.S.A.), August, 1952, p. 44.

The grid-dip oscillator is a very useful piece of test equipment, but construction and calibration is a time-consuming task. An inexpensive R.F. oscillator can, by the method described, be converted to a grid-dip oscillator capable of tuning between 160 kc/sec. and 50 mc/sec.
—*Ibid*, p. 66.

Signal tracing as a servicing technique, offers great advantages, but has been somewhat difficult to apply to TV servicing. The difficulty is partly due to the fact that the oscilloscope may not have sufficient gain in the vertical amplifier, and the probe shown includes a lightweight directly-coupled wide band amplifier. Construction hints and application are described.
—*Ibid*, p. 58.

MATERIALS, VALVES, AND SUBSIDIARY TECHNIQUES

There is now a very great variety of TV picture tubes to choose from, and replacement problems are sometimes difficult. The article covers basic tube types, their characteristics, and data on substitution.
—*Ibid*, p. 50.

A wide-range oscillator in the band from 8,000 to 15,000 mc/sec. In the construction of resonant cavities for oscillators it is sometimes necessary to insulate some part of the cavity. A resonator is tuned by moving the repeller parallel to the axis of symmetry, and the oscillator works in a manner very similar to a reflex klystron in that the electrons receive velocity variations in part of the trajectory.
—*Proceedings of the I.R.E.* (U.S.A.), July, 1952, p. 813.

The R.F. characteristics of capacitors. The limitations imposed on the effectiveness of a given capacitor in a circuit by the operating frequency, or frequencies, are often overlooked or ignored by users. As a result the circuit either tends to become unstable, or the capacitor is not fully effective, and a different type of capacitor is required. A table of inductances for various types with the self-resonant frequency is given to assist design.
—*Wireless World* (Eng.), August, 1952, p. 303.

A C.R.T. monoscope tube has been developed to provide output closely resembling the directivity patterns of a radar antenna. The variation of secondary electron emission from aluminium with angle of incidence is used as the basis for design. The conical target is so shaped that variation of the target current with beam deflection corresponds to the variation of a received radar signal with angular displacement of the radar antenna.
—*Proceedings of the I.R.E.* (U.S.A.), June, 1952, p. 666.

MATHEMATICS

Constant K type high-pass filter design. As the damping characteristics of the constant K type filter are not sharp, accurate calculations are not necessary. From the chart it is possible to determine L and C if the cut-off frequency and the image impedance are known.
—*Radio and Television News* (Eng.), August, 1952, p. 54.

RECEIVERS

How to choose the right by-pass capacitor. The selection of a capacitor of the proper type and value for a given job is an important aspect of circuit design, and the basic facts of degeneration, filters, etc., are dealt with in simple form.
—*Radio and Hobbies* (Aust.),, September, 1952, p. 77.

The subject of "noise." A continuation of an earlier article which deals with the practical effects of noise and rescuing the signal from it; also the question of noise from a tuned circuit. The use of triodes at high frequencies is explained in order to combat noise, and its repression in triode circuits is referred to.
—*Wireless World*, June, 1952, p. 222.

TRANSMITTERS AND TRANSMITTING

Microwaves for the "ham." The advent of TV in the United States will provide a powerful impetus for "kicking the amateurs upstairs." This is not without great interest to the designer and new and fascinating techniques are being developed. Notes on these techniques are given, various types of "plumbing" and tubes for producing microwaves.
—*Radio and Television News* (U.S.A.), August, 1952, p. 31.

An improved speech clipper. Premodulation speech clipping and filtering has become an accepted and proven method of increasing sideband power from phone transmitters. Certain disappointing results sometimes result from such apparatus which the design given is intended to overcome. The apparatus is designed for the "ham," and circuitry is given.
—*Ibid*, p. 57.

The mobile "Band Hopper." The small compact transmitter is effective for 75, 20, and 10 metre bands. The R.F. section uses a 6AG7 Tri-tet oscillator to drive a 2E26 amplifier that works straight through on the three bands. The audio section consists of a 6AQ5 driver transformer-coupled to a class B modulating stage, and the whole can be placed in an 8 in. x 8 in. x 1 in. chassis.
—*QST* (U.S.A.), August, 1952, p. 22.

A flea-power portable C.W. station, which with batteries is easily carried in a small handbag, and includes a receiver. The apparatus is built around one 6SL7 and one 6SN7, and operates on the 40-metre band.
—*Ibid*, p. 24.

A simple oscilloscope is designed especially for checking and monitoring A.M. phone signals. Its purpose is for checking modulation, and is small enough to be mounted in a transmitter rack or cabinet. The instrument can be switched instantly to show three different types of patterns, each having its advantage.
—*Ibid*, p. 31.

(Concluded on Page 48.)

CRESSALL

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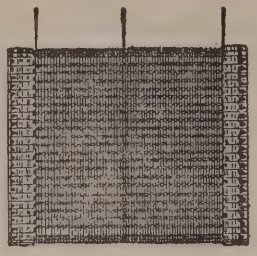

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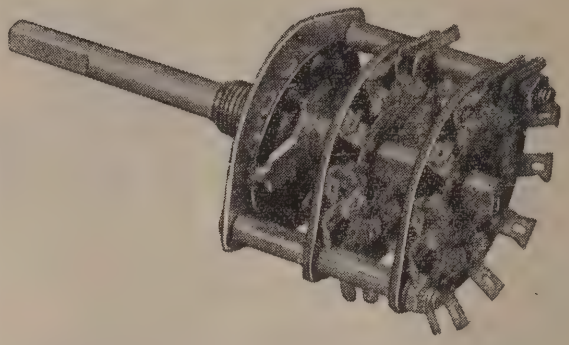

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CONDENSERS

	Specification	Volts		Fig.	No.
C1	NOT USED				
C2	Gang Condenser.			3	800034
C3	100 pF Ceramic			3	666520
C4*	3-35 pF Trimmer		20%	3	800034
C5	0·1 μF Tubular	350		3	668638
C6	0·04 μF Tubular	150		3	669106
C7	330 pF Mica		20%	3	665720
C8	100 pF Ceramic		20%	3	666520
C9	100 pF Mica		2%	3	664272
C10	22 pF Ceramic		20%	3	666572
C11	100 pF Mica			2	666776
C12	Gang Condenser			3	800034
C13	3-35 pF Trimmer			3	800034
C14*	0·1 μF Tubular	350		3	668638
C15	100 pF Mica			2	666776
C16	100 pF Ceramic		20%	3	666776
C17	10 pF Ceramic			3	665525
C18	0·04 μF Tubular	150	20%	3	669106
C19	100 pF Ceramic		20%	3	666520
C20	100 pF Ceramic			3	666520
C21	0·01 μF Tubular	350	20%	3	669096
C22	0·005 μF Tubular	1000A.C.		3	668845
C23	25 μF Electrolytic	12		2	
C24	32 μF Electrolytic	350		2	666500
C25	32 μF Electrolytic	350		2	
C26	32 μF Tubular	600A.C.		3	668850
C27	0·02 μF Tubular			3	

RESISTORS

	Ohms	Watts	Fig.	No.
R1	NOT USED			
R2	2·2 meg		20%	3
R3	15,000		10%	3
R4	47,000		10%	3
R5	220		10%	3
R6	47,000		10%	3
R7	680,000		20%	3
R8	220,000		20%	3
R9	150,000		20%	3
R10	470 meg		20%	3
R11	470 meg		20%	3
R12	330,000		20%	3
R13	680,000		20%	3
R14	100,000		20%	3
R15	0·8 meg Volume Control		10%	3
R16	150			
R17	1,500		10%	3

SWITCHES, ETC.

	Specification	Fig.	No.
S1	Radio and Gram Switch	3	830306
S2	Tone Control	1	710649
S3	Gram Motor Autostop	3	810223
S4	Mains ON/OFF (on Vol. Control)	2	
M	Gram. Motor		

INDUCTANCES

	Specification	Fig.	No.
L1	Frame Aerial	1	732377
L2	Oscillator Coil	2	780339
L3	Loudspeaker	1	850019

TRANSFORMERS

	Specification	Fig.	No.
T1	1st I.F. Trans. (Prim. 12·2 Ω; Sec. 12·2 Ω)	2	770369
T2	2nd I.F. Trans. (Prim. 12·2 Ω; Sec. 12·2 Ω)	2	770369
T3	Output Trans. (Prim. Start to Tap 18 Ω; Prim. Start to Finish 500 Ω)	2	770397
T4	Mains Trans. (Prim. 45 Ω; Sec. 160+185 Ω)	2&3	770807

† Integral Part of I.F. Transformer.
* Part of Gang Condenser.

NEW ZEALAND RADIO DX LEAGUE

"This is Radio Station KSIG, Crowley, Louisiana, conducting its regular monthly frequency check programme on an assigned frequency of 1450 kilocycles, with an authorized power of 250 watts."

To the average listener, this would be a surprising announcement to hear on the radio. Surely no American station uses the low power of 250 watts on the broadcast band! To the many members of the New Zealand Radio DX League, however, announcements such as this are almost everyday occurrences.

As the name implies, the membership of the N.Z. Radio DX League comprises those interested in long-distance reception. After dissatisfaction with the now defunct New Zealand DX Club, the first DX Society formed in the Southern Hemisphere, the DX League was formed in 1948. Among its officers are some of the Dominion's leading DXers, the President being F. W. Wilson; Vice-Presidents, A. M. Branks and K. A. Mackey; the Secretary, D. L. Lynn (ARA. NZ), and the Board Members, A. J. Allan, A. T. Cushen, J. Blacklock, J. F. Fox, W. J. Marshall, and W. S. Milne. In fact, all the foremost DXers in New Zealand are members of the NZRDXL. On the broadcast band, A. L. Stanton, Dunedin, has 1409 verifications, F. W. Wilson, Dunedin, 1164, K. A. Mackey, Dunedin, 1058, A. T. Cushen, Invercargill, 911, A. M. Branks, Invercargill, 904, while the "lesser" lights include many members with 500 or more verifications on the broadcast band. On short wave, A. T. Cushen, Invercargill has 1466 verifications, W. S. Milne, Invercargill 829, J. Corbett, Brisbane, 713.

The object of the League is to promote interest in long-distance reception. The DXer lists details of the programme heard from an overseas station, together with information concerning the reception conditions, receiver used, signal strength, fading, interference, etc. After the checking of the report with the station's log, verifications are issued in the form of letters, or attractive cards, confirming the reception of the station by the DX listener.

Notes on members' activities and the latest station information gathered from many overseas sources are published in the monthly bulletin, "The New Zealand DX Times." Compered by J. I. Martin, the League's radio session, "New Zealand DXers Calling" is broadcast from Station 4XD, Dunedin, on 1430 kc/sec. each Wednesday at 8.45 p.m., and supplies members with a speedy means of learning the latest details concerning stations heard by New Zealand listeners. Now well established as a regular feature of the League's activities, this session recently celebrated its 100th broadcast.

Monthly meetings to which members bring their coveted verifications are held by all the League branches, thus providing opportunity for personal contact and a furtherance of knowledge by talks and quiz sessions, etc. A booklet showing the method of writing reports to stations, and other elementary items of interest to the beginner, is supplied to all new members.

Other than DX, the League's activities embrace many ventures in which the DX knowledge has been of great assistance both to radio listeners and to the general public, to say nothing of promoting world-wide friendships. The League's call-book for radio manufacturers is well known. Its members help stations find better frequencies, cable weekly reports to London on B.B.C. reception, monitor special broadcasts for the press, arrange special broadcasts dedicated to listeners in this area, and in general, do everything possible to promote better relationship between the radio station and its listeners.

Of world-wide interest is the League's monitoring of radio stations for propaganda and prisoner of war information. The latter service was first operated during World War II, during which period some 6,000 names of Allied servicemen, mainly New Zealanders, were monitored, and the messages mailed to the next-of-kin. The gratitude of parents and relatives on receiving this news, often the first since the men were reported missing, was indeed overwhelming. The Far East monitoring, in which civilian internees were heard broadcasting, in some cases provided the first news of the latter for two years. The Korean war brought about a resumption of the service, and before the P.O.W. list was exchanged last December, the League had more than 2,000 names of United Nations personnel on its files—more than half the number known to the United Nations, and a far cry from the 165 men officially known as prisoners of war at that time. Once again, this news from the N.Z. DX League often brought to some mother in the U.S.A. the first relief for twelve or eighteen months. Without a break Peking was monitored every night, even though conditions were often bad. All reports were sent to Invercargill from whence the information was air-mailed on a special form to the next-of-kin, as well as the American Embassy in Wellington. Notwithstanding the cessation of P.O.W. messages in January last, the activities of the League have not ceased. Countless inquiries are still being received concerning the 6,000 men not on the official list, but many of whom were heard broadcasting late last year. Their fate is unknown, but the League keeps listening and hoping. Countless dozens of letters have been sent to the camps on behalf of relatives in the U.S.A., and members are frequently cheered by the news that through this service, prisoners, after months of life in P.O.W. camps, are at last able to establish contact with relatives at home.

For those interested, all further inquiries about the League, its activities, and its monitoring services, should be addressed to the National Secretary, NZRDXL, 15 Plunket Street, Dunedin, S.2, New Zealand.

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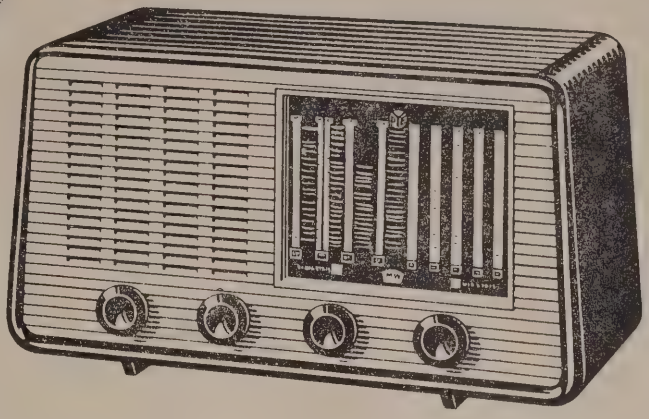

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Stolen Radios

Criminal Investigation Branch, Auckland

"Antone" portable, 4-valve A.C. and D.C., serial No. 280. Cream plastic cabinet, 12 in. x 5 in. x 5 in., dial 5 in. x 3 in, with black figures on golden background, numbers 60 to 100. Extra aerial terminal fitted in back of set. About 6 ft. flex fitted with 3-point plug.

"Ultimate" battery, 5-valve portable, brown imitation crocodile skin cabinet, wood base. Dial 6 in. x 3 in, with gold background and red dots for stations. Two brown bakelite control knobs. Grease stain above dial.

One "Bell" radio, serial No. B.P. 1124, Licence No. 27,824. Five-valve battery-A.C., fitted with plug for electricity, dark brown bakelite case, 14 in x 7 in. x 6 in. "P.M." magnetic speaker.

One "Skyscraper" "Tiny" model, serial No. 145,866, 4 valves. Brown or ivory plastic cabinet 12 in. x 9 in. x 5 in., 5 in. "Rola" speaker, printed celluloid dial on right. Two tuning knobs.

Police Station, Inglewood

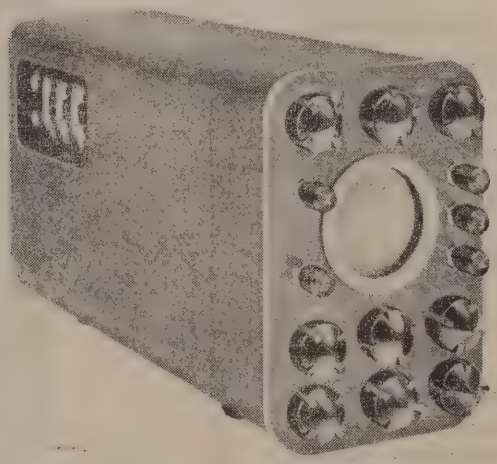
Six-valve mantel model "Gulbransen," serial No. 33,613, eight years old. Dark cabinet with tack marks on back.

Criminal Investigation Branch, Palmerston North

One "Sheffield," serial No. 2093, Licence No. 3924. Grey and black cabinet, two control knobs with switch for tone.

Police Station, Taranaki Street, Wellington

One dual-wave, 7-valve mantel model "Gulbransen," chassis No. 6691, Royalty No. 14537.



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PUBLICATIONS RECEIVED

G.E.C. Journal, April, 1952: The General Electric Co., Ltd., of England. (British General Electric Co., Ltd., New Zealand.)

B.I.C.C., Bulletin No. 6: British Insulated Callenders Cables Ltd., England. (National Electrical and Engineering Co., Ltd., New Zealand.)

Review, August, 1952: National Electrical and Engineering Co., Ltd., New Zealand.

Brochure, New Components: Inductance Specialists Ltd., New Zealand.

Leaflets, Rotary Switches: G. W. Engineering Co., Ltd., Sydney. (Bradley's Electrical Co., Ltd., New Zealand.)

Pamphlets, "Induction Motors": Birmingham Sound Reproducers, Ltd., England. (E.M.I. Supplies, Ltd., New Zealand.)

Brochure, Electric Bed Sheet: Chalfont Electrical Co., Ltd., England. (E.M.I. Supplies, Ltd., New Zealand.)

Stock Record, August, 1952: Cory-Wright and Salmon, Ltd., New Zealand.

Philips Technical Review, September, October, November, December, 1951: N.V. Philips Gloelampenfabrieken, Eindhoven. (Philips Electrical Industries of New Zealand, Ltd.)

Electrical Communictaion, March, 1952: International Telephone and Telegraph Corp., England. (Standard Telephones and Cables, Pty., Ltd., New Zealand.)

Philips Bulletin, August/September, 1952: Philips Electrical Industries of New Zealand, Ltd.

Radiotronics, August and September, 1952: Amalgamated Wireless Valve Co., Pty., Ltd.

A.P.A.E. Journal, July and August, 1952: Association of Public Address Engineers, England.

Niven News, No. 24, 1952: Jas. J. Niven & Co., Ltd., New Zealand.

Catalogue of Mullard Receiving Valves and Special Electron Tubes: Mullard Overseas Ltd. (C. and A. Odlin Timber and Hardware Co., Ltd., New Zealand.)

Catalogue, G.E.G. Telecommunications: The General Electric Co., Ltd., England. (British General Electric Co., Ltd., New Zealand.)

Electronic Measuring, Vol. 3, No. 6: Philips Electrical Industries of New Zealand, Ltd.

Electronic Application Bulletin: N.V. Philips Gloelampenfabrieken, Eindhoven. (Philips Electrical Industries of New Zealand, Ltd.)

Westinghouse Engineer, July, 1952: Westinghouse Electric Corp, U.S.A. (H. W. Clarke (N.Z.) Ltd.)

Telcon House Magazine No. 16: The Telegraph Construction and Maintenance Co., Ltd., England. (Amalgamated Wireless (A'sia) Ltd.)

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Proceedings of the New Zealand Electronics Institute Incorporated.

HEADQUARTERS NEWS

The last meeting of the Executive Council was conducted in a rather unusual manner in that a continuous link was achieved with Dunedin Branch per medium of telephone communication amplified through a loudspeaker. This innovation was a distinct success and was a saving in cost, due to the fact that the expenditure incurred would have been greater if the two delegates from Dunedin had been obliged to travel to Wellington to attend the meeting.

Next Meeting Date.—By the time these Proceedings have been published the next meeting of the Executive will have been held, and it is proposed to continue with a telephone link-up, if possible including Christchurch and Dunedin both linked to Wellington.

BRANCH NEWS

Christchurch

As the new President of the Institute, Mr. B. Withers, is located in Christchurch it is anticipated that this Branch will now forward considerable news for inclusion in these Proceedings.

It is understood that a full programme is being arranged for members and details of this will be released very shortly.

Dunedin

At the last Dunedin meeting an attendance of 49 members and visitors was presided over by Mr. W. L. Shiel, and a lecture on "High Fidelity. Is It Worth It?" was given by Messrs. Symmons and Andersen.

Messrs. Symmons and Andersen stated that the problem with which they proposed to deal was that of good fidelity reproduction of orchestral music under the conditions to be found in an ordinary sitting-room. It was pointed out that there appeared to be no reference in the literature to a definition of absolute fidelity from which an engineer could obtain ideal curves to which he could aim. The authors, therefore, proposed their own definition.

Messrs. Symmons and Andersen said that it was essential that the general volume level of the music reproduced in an average room was much reduced compared with that experienced in a hall during a live performance. Graphs of the response of the ear against frequency were shown, which demonstrated how a general reduction in level would affect the frequency range perceptibly, and would upset the balance between notes. It was shown how, from these curves and the definition of absolute fidelity which the authors proposed, it was possible to obtain ideal tone correction curves required for reproduction at levels suitable for small rooms.

Demonstrations were given of various types of music played back under different tone control conditions.

Curves were exhibited which showed how closely it had been possible to approach the ideal curve. It was obvious that though not perfect tone compensation had been achieved, nevertheless, the practical curves were very good approximations to the ideal. The authors believe that it will prove possible to obtain even better curves with a little more effort.

The practical methods used to achieve perfect tone compensation were outlined, and it was pointed out that it is an essential requirement that the actual sound present in the position of the listener's ear is what matters. For this reason the checking and modification of the tone correction circuits had to be made by use of an objective noise meter, placed in the position of the listener, in the actual room to be used, with its normal complement of furniture, and so on, and with the actual speaker and baffle to be used placed in its desired location. In other words, the equipment has to be "tailored" to the conditions of actual use.

Curves were shown also illustrating how very short of ideal was the reproduction from a first-class table model commercial radio.

Various difficulties were to be expected to arise due to the limitations of various items of equipment needed in a reproducing system (records, pick-up, loudspeaker, etc.). It was emphasized that unless first-quality equipment was used there was practically no hope at all of achieving the ideal compensation. For this reason the cost of setting up a really high fidelity system was very high. The authors had been quoted a price of something like £150 for materials alone if starting from scratch, and something like £220 if the whole job was to be done by a professional man.

The question "Is it worth it?" can obviously only be answered by the individual who must balance the high cost against his desire really to hear music from his records.

At the conclusion of the lecture the loudspeaker was moved into a small office, the acoustics of which were similar to those of an average sitting-room, wherein the audience, a few at a time, were enabled to hear the reproduction under conditions similar to those for which the system was modified.

At the conclusion of this exceptionally interesting lecture, a hearty vote of thanks was passed to the lecturers and also to Dr. Galway, Mus.Bach., for his assistance in providing the piano accompaniment. The Institute also expressed its appreciation of the consideration of the Broadcasting authorities and also of Mr. Halchrow, Chief Engineer, Dunedin, for his support in making available the recording facilities of the studio.

As a demonstration of public interest in electronics, the attendance at this lecture was most gratifying and the features in the *Evening Star* dealing with the lecture and the work of Messrs. Symmons and Andersen are sure to excite public interest in electronics and in the activities of the N.Z.E.I. Inc. in particular.

Wellington

At the monthly meeting of the Branch, held recently, a demonstration of aluminium soldering by Messrs. Philips Electrical Industries (New Zealand) Limited, was given and was then followed by a discussion of the Wellington Branch, N.Z.E.I. television project. Arrange-

(Continued on Page 48.)

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DRAWING CURVES ON THE OSCILLOSCOPE—PART II

PRACTICAL CIRCUITS FOR DRAWING PARTICULAR VALVE CURVES

Before we embark on a description of the circuits needed to draw particular kinds of valve curve, it should be mentioned that the figure numbers from now on refer to those found in this instalment of the article, and not to those in the first instalment, which were also numbered from 1 upwards.

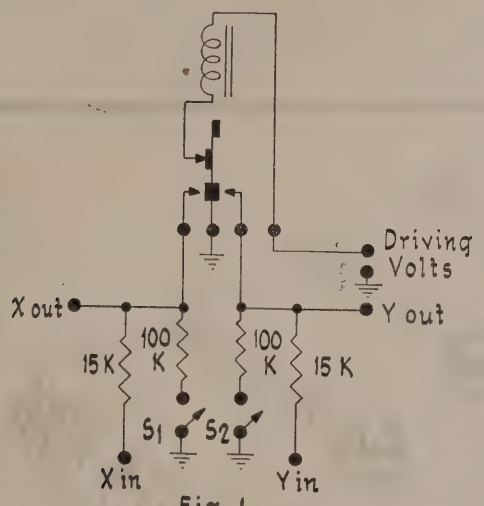

Fig. 1

Fig. 1 shows a basic circuit which can be built and kept as a standard device if so desired. There is very little in it, and by its means, simple connections and the throwing of the switches will enable curves to be drawn for diodes, the grid-plate characteristics of triodes, and the plate characteristics of triodes and pentodes. For each of these a small auxiliary circuit is required, and these are shown in Figs. 2, 3, and 4. It will be seen that

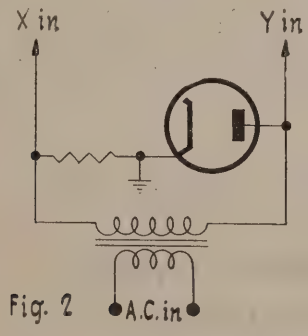

Fig. 2

the circuit of Fig. 1 closely resembles the basic circuit given in Fig. 2 of the first part of this article. The necessary amplifiers are not shown, but these are quite conventional, and can be the amplifiers already built into the oscilloscope for the X and Y axes. First of all, let us take Fig. 2, which is suitable for drawing the curves for all types of diode, whether valve, crystal, or metal rectifier type. The unmarked resistor is in series with the current through the diode, and so develops across itself a voltage proportional to that current. The value has not been marked in, because the size of resistor needed is different from different diodes. It should always be as small as possible with respect to the internal resistance of the diode if a true characteristic is to be obtained. Therefore, the rule of using the circuit is to use as much amplification as possible in the X amplifier, allowing the resistor to be made very small. The transformer voltage depends upon the range of voltages over which the curve is desired, and upon the highest instantaneous voltage that is safe for the device under test.

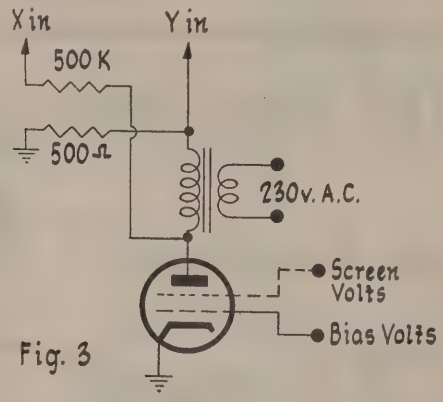

Fig. 3

As explained earlier in the article, the peak voltage can be much higher than the rated steady voltage, and thus give portions of the curve that could not be obtained otherwise. The gain controls of the X and Y amplifiers should be adjusted to give a curve resembling in shape the curves drawn by the makers, so that a visual comparison can be made.

In Fig. 3 we have the set-up needed for showing the plate-volts/plate-current curve of a triode or pentode. Here we need D.C. supplies only for the screen and control grids, and the A.C. signal is applied to the plate circuit. This looks a trifle peculiar, but a little reflection will show that it is quite sensible! Any valve curve is drawn with one of the three main variables held constant. In this case, it is the grid voltage, and we are interested in the variation of plate current when the plate voltage is varied. Thus, we fix the grid voltage by means of a battery, or other source, and apply A.C., which is our varying voltage, to the plate. Although we know that the plate circuit passes no current at negative plate voltages, this need not disconcert us, since it will simply show on the curve as no Y deflection on the negative side of the X axis. In Fig. 3 it will be noted that there is a 500k. resistor placed between the plate of the tube under test and the X input terminal. This is only to reduce the input voltage, since this will be very high. The value of 500 ohms shown for the current resistor is small enough for all practical purposes, being much less than the plate resistance of almost any likely triode or pentode. For drawing the curves of small valves, usually used as voltage amplifiers, the Y sensitivity may be a little low, and as long as the type of valve is correct, this value may be considerably increased. For triodes, it will not be possible to increase it without destroying the proper shape of the curve for the valve alone, but with pentodes, whose plate resistance is one

megohm or more, the resistor can be increased to 5000 ohms without causing any noticeable discrepancy. Each case has to be examined on its merits, and as long as the basic principles of valve curves are remembered, no trouble will occur. For comparative purposes, where it is only desired to show the curve as a comparison with a standard, or "bogey" tube, it really does not matter if the current resistors are somewhat greater than is needed to give a true valve curve. This is because the absolute shape of the curve is not influenced too much by the resistor unless it is made quite large.

In Fig. 4 we have the set-up for showing the grid-voltage/plate-current curves of a triode or triode-connected pentode. Here, the D.C. voltages are applied to the plate (and screen in the case of a pentode) while the

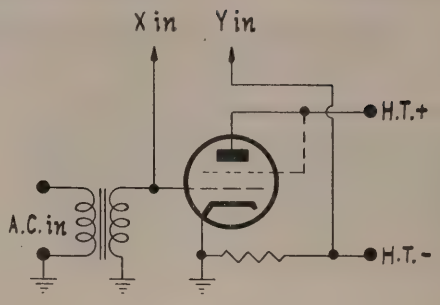

Fig. 4

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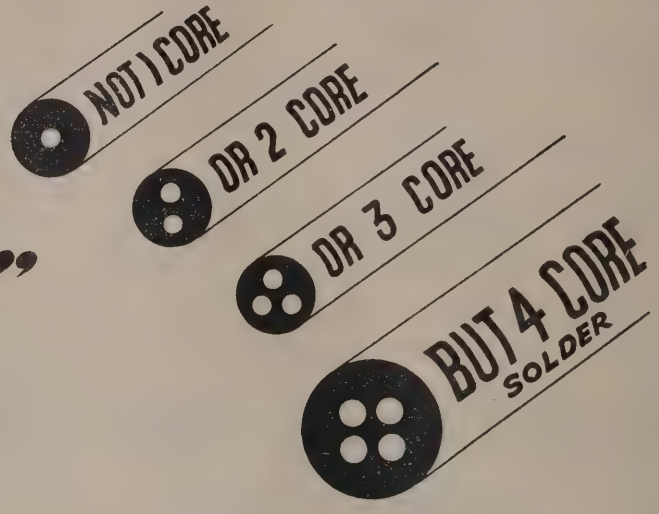

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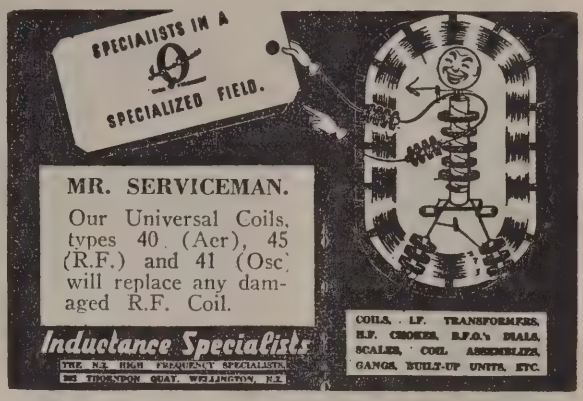
variable voltage is applied to the grid in the conventional manner. Here again the current resistor has not been marked as having any particular value, because the value to be used will vary widely with the type of valve under test. The rule here is still to use as small a resistor as possible. As will be seen from the circuit, the resistor will not introduce negative feedback which would modify the curves still more. A value of 500 ohms here would not be excessive, and a figure of 50 ohms is nearer the mark for most power valves, the higher values being used for smaller ones. To avoid the negative feedback, it would be necessary to put the resistor in the plate side of the circuit rather than in the cathode, as here. Another point concerns the use of this arrangement for pentodes. The arrangement shown is quite suitable, provided that the screen is supplied with a fixed voltage. The source should be connected between cathode and screen, and not between H.T. and screen, otherwise the current resistor prevents the screen from being at the same potential as the cathode.

CONCLUSION

There are many more things that can be done with such a curve-drawing arrangement than we have shown in these few simple examples. For instance, one very useful application would be for putting in the axes in the input-voltage versus output voltage curve of an amplifier, so that the departure from exact linearity

(Continued on Page 48.)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N.Z. Radio and Television Manufacturers' Federation Annual Meeting 1952

SNAPS TAKEN AT THE CONFERENCE

1. Mr. R. Slade, newly appointed President.
2. Some delegates take the air.
3. Mr. Clifton Lewis, new Vice-President.
4. Inspecting the gear in the Radio Inspector's car.
5. An absorbing problem (or "Close Liaison!")

(We are indebted to Ray Walker for the above photos.)

Good fellowship was the keynote at the Annual Meeting of the New Zealand Radio and Television Manufacturers' Federation held at Waitomo on 18th and 19th September.

Official delegates were: Messrs. T. J. F. Spencer (President), Akrad Radio Corporation, Ltd.; R. Slade (Vice-President, Philips Electrical Industries of N.Z. Ltd.; R. J. Orbell; S. A. Heginbotham, H.M.V. (N.Z.), Ltd.; J. S. Oxley, Swan Electric Ltd.; W .J. Meighan, Sheffield Radio Ltd.; T. R. Gobby, Dominion Radio and Electric Corp.; H. W. Henderson, Radio Corporation, New Zealand, Ltd.; J. Carpenter, National Carbon Pty., Ltd.; E. Undrill, Philips Electrical Industries of N.Z., Ltd.; D. P. Joseph, Industrial Electronics, Ltd.; D. T. Clifton-Lewis, Radio (1936) Ltd.; R. Walker, Autocrat Radio Ltd.; W. Somerville, Secretariat.

Visitors included Messrs. B. Bookman, Advertising Counsel, W. L. Harrison, Chief Engineer, N.Z.B.S., Mr. A. H. Buchanan, Chief Radio Inspector of the P. & T. Department, guest speakers, and C. H. Roser, of *Radio and Electronics*, the Federation journal.

Under pleasant weather conditions and the cordial atmosphere prevailing at the Hotel Waitomo, the conference was voted a great success. Time was found for visits to the famous caves, and the energetic were able to display their prowess at billiards and table tennis. Scene of much conviviality was the bar lounge, especially during the "toasting" parties to the two young brides in the party. At the official dinner on Thursday evening, wit and good cheer prevailed, Cliff Lewis entertaining all with his repertoire of stories.

Another highlight was the film evening at which Mr. W. L. Harrison of the N.B.S. showed films taken during his recent tours of Great Britain, Canada, U.S.A., and Mexico, concluding with shots of New Zealand by way of scenic comparison. Incidentally, admiration for that old radio veteran, Robie, knew no bounds as he was seen taking the waters in as clean a dive as ever known. Robie is well known as a winter-time lunch-hour swimmer at Te Aro.

"The problems of television and the prospects of its early introduction to New Zealand" was the subject of an address by Mr. W. L. Harrison, who, however, adroitly avoided giving any indications of Government policy in this respect.

In his Presidential Annual Report, Mr. T. J. F. Spencer mentioned that earlier in the year it appeared that a tariff review was to be scheduled by the Board of Trade for March, April, 1953. Recent inquiries, however, had elicited that such is not the case.

In spite of the Federation's repeated representations, the Board of Trade has upheld the principle of granting token import licences for radio receivers. During the past year it is believed that there have been comparatively large importations of car radios, which have been permitted to come into New Zealand as part of a complete motor-car. However, as a result of strong representations made to the Board of Trade, it is believed that this practice is likely to be curtailed.

As yet, the Board of Trade has reached no decision regarding the 1953 importation of static condensers from overseas. The Federation has asked that the 1952 position be repeated for 1953, and probably will have to appear before the Board of Trade to substantiate claims to continue the importation of condensers.

Mr. Buchanan, Chief Radio Inspector, spoke on the activities of his Department from the period 1928, when push-bike was the recognized transport for local inspectors, to the present day, with its 17 inspection centres, 500,000 licences, and 25 inspectors with up-to-date test equipment installed in their cars. At this juncture, opportunity was taken to inspect the car and equipment of the local Hamilton Inspector who was present at the meeting.

As a direct outcome of representations made by the industry to the Commission on Patents, a new Licensing Agreement has been concluded with A.R.T.S. and P. which seems to be satisfactory to all concerned.

Again due to the efforts of the Federation, an Interdepartmental Committee on interference problems has been set up, which is likely to function more fully and effectively than was at first anticipated. This should result in greatly improved service to radio listeners.

As yet, the establishment of a Television Service seems no nearer, but the Interdepartmental Advisory Committee has presented a report to the Government, which is believed to incorporate recommendations regarding standards. It is significant, however, that television is becoming more and more widespread, and it is inevitable that sooner or later a service must be provided in New Zealand, through pressure of public opinion if nothing else. The Federation, however, is confident that the N.B.S. will be ready to provide the technical part of the service as soon as required.

During the year the overseas supply position has improved materially, but paradoxically our ability as a nation to pay for the goods we want has worsened. The present system of exchange control seems particularly clumsy, but the New Zealand Manufacturers' Federation is watching the interests of all manufacturers and doing its best to obtain alleviation and assist manufacturers where circumstances warrant it.

Concluding his report, Mr. Spencer expressed his grateful appreciation of the sterling services rendered by the Vice-President, Executive, and Secretariat, and extended his best wishes for the coming year.

With an agenda paper of 22 items and 14 remits, the conference was a very busy one. However, under the able chairmanship of the President, Mr. Spencer, and with the co-operation of all delegates, all business was concluded within the allotted time, even though debates on certain topics were extremely lively.

Items of special interest included:

Broadcasting Hours

After a discussion of the reasons for the present restricted broadcasting hours, the Conference resolved to approach the authorities for the restoration of the previous hours of broadcast.

Television

It was decided that the Government be pressed to make a statement on the prospects of television in New Zealand.

Price Cutting

In view of the possible shortage of raw material, the conference considered that a warning should be issued on the dangers of indiscriminate price cutting. It recommended the exchange of surplus raw materials among members.

Patents

A sub-committee consisting of Messrs. Cunninghame, Slade, and Collier was set up to submit proposals to the Government concerning the framing of legislation on those recommendations made in the Patents Committee Report.

Currency Control

After a full discussion, the conference endorsed the negotiations by the New Zealand Manufacturers' Federation with the Reserve Bank, and adopted the recommendation of the latter to apply for the first six months' allocation.

Department of Industries and Commerce

To simplify matters for the above Department, it was decided that a sub-committee be appointed by the incoming executive to deal with matters concerning import licences for equipment and radio components. In future, all inquiries concerning the above should be addressed by the Department to the Federation's secretariat, whose responsibility it would be to refer same to the sub-committee.

Importation of Built-up Assemblies

Following a discussion on imported wired-up components, in particular certain car radio tuning heads, it was decided to refer this question to the special Import Licences Sub-committee, with the object of preventing the importation of completed assemblies.

Radio Award

Appreciation was expressed of the work done and the report on industrial matters presented by Mr. N. Souper, representatives of the Traders' Federation, and it was resolved that he should be co-opted to the Federation Executive.

Interference

In the meantime, no further Federation action re the above was contemplated in view of the talk and explanations given by Mr. Buchanan.

Radio Survey

Mr. Bookman, Federation Advertising Counsel, referred to previous discussions and emphasized the advisability of the industry taking a survey of radios in use and investigating the possible field for larger sales. This matter was referred to the incoming executive to make some recommendation.

Radio Programmes

During the discussion concerning desirable alterations to the present form of programmes, Mr. W. L. Harrison proved very helpful, outlining the difficulties involved in providing a full coverage for the scattered population of New Zealand. He advised that, in future, there will be more inter-station linking, but it must be remembered that in New Zealand we have not the advantage of the prolixity of talent available in London and other large centres. However, the types of programmes in the four main New Zealand centres are not unlike those provided in Britain. There are four stations from which to choose. YA, new and fixed items; YC, classical; ZB, commercial and light; and lastly YD, light (for good measure). Though it had no recommendation to make, the conference recorded its appreciation of the N.B.S. programme service.

Reception

Mr. Harrison explained the difficulties of entirely removing double spotting, particularly in Dunedin. As the bands are allotted internationally and cannot be altered easily, his suggested remedy was the equipping of sets with pre-selectors. At present the provision of further transmitting stations is not contemplated, though consideration is being given to the fact that some dis-

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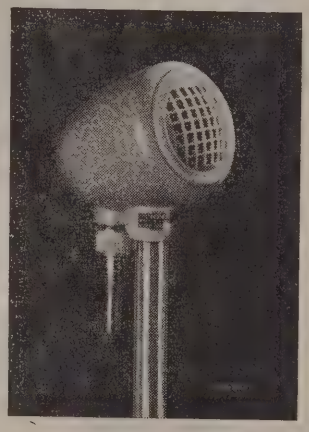

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Speaker Shortage

It was learned that the demand for oval speakers can now be met from local production.

The election of officers resulted as follows:—

President: Mr. R. Slade.
Vice-President: Mr. D. T. Clifton-Lewis.
Treasurer: Mr. W. I. Cunninghame.
Secretariat: Office of the Manufacturers' Federation.
Delegates to Executive: President and Vice- President, Immediate Past President, Messrs. T. R. Gobby, W. J. Meighan, P. C. Collier, W. I. Cunninghame, L. H. Wright.

Both Mr. Spencer and Mr. Slade were accorded hearty votes of thanks for their outstanding work for the Federation, and the Secretary, Mr. W. Somerville was thanked for his able services and the creditable manner in which he had organized the conference.

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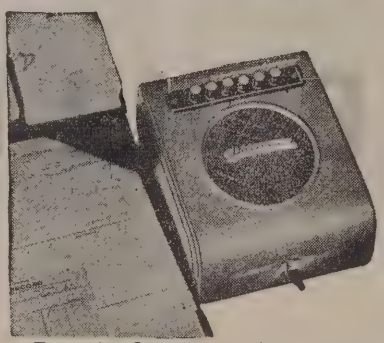

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Industrial efficiency depends on speed in communication. Of necessity each installation requires its own design and Ultimate's skilled technicians, with many years of experience, are fully qualified to advise on your particular problem. Write for further information on Ultimate's Communication Specialties.

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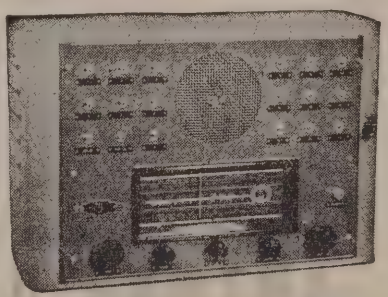

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TRADE WINDS

On 4th September at Wellington's Majestic Cabaret, the annual NEECO ball attracted almost 350 guests, and proved even more successful than its predecessors.

Highlight of this year's ball was the excellent floor show, which has set a new standard for cabaret entertainment, the all-male trio playing the "Andrews Sisters" being one of the cleverest shows seen in many a long day.

* * *

Balls were the order of the month during September in Wellington, and another most successful function also held at the Majestic Cabaret was that of the Lower Hutt and Wellington branches of Turnbull and Jones, Ltd., held on 25th September. For this occasion the cabaret was decorated with huge clusters of gaily coloured balloons, and the two novelty dances were quite a feature of the evening.

N.Z. RADIO, TELEVISION, AND ELECTRICAL TRADERS' ASSOCIATION (AUCKLAND)

On 24th September seven members of the Executive of the New Zealand Radio, Television, and Electrical Traders' Association visited Hamilton to meet members of the trade operating in the Waikato area.

The matter of some form of protective trading was stressed, the consensus of opinion being that the time had arrived for the taking of some action to keep the marketing, servicing, and selling of radios and component parts within the trade. It was considered that a fair trading policy was essential for the stability of the industry, and it was felt that steps should be taken to eliminate unfair trading practices such as buyer inducement, whereby articles were given away with radios, the cutting of prices on standard models, and giving discounts to special organizations, such as the Public Service Association. This was considered tantamount to a tax on the remainder of the community. The Executive has undertaken to prosecute these matters to their utmost limit, and to endeavour during the next few months to bring about a fair trading policy in the Auckland province.

To foster the work of the Association and watch the interests of traders in their own areas, representatives of the Association have been appointed in each of the Waikato centres.

"RADIO-GEN"

Is now on sale, price 9d. a copy, or subscription 10s. per annum posted. Obtain your copy from Radio Dealers, or write to "Radio and Electronics," P.O. Box 8022, Wellington.

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Precision manufactured for radio frequency and other purposes.

Specialists in ceramic rods and tubes up to 44 inches long and $1\frac{1}{4}$ inch square and tolerances within plus or minus 0.0005 inch.

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New Zealand Radio Traders' Federation

At an executive meeting of the New Zealand Radio Traders' Federation, held on 3rd September, many matters of importance to the industry were discussed, including:

Guarantees

This will be discussed by the Radio Manufacturers' Federation at an early date.

Federation Bulletin

The editorial committee was congratulated on the first issue of this Bulletin. From the number of letters received from localities where there is at present no association, or the local association is not as active as it should be, it is evident that this renewed stimulation of interest justifies the wide distribution of the bulletin.

Radio Manufacturers' Conference

Following the Radio Manufacturers' Federation acceptance of the Radio Traders' Federation suggestion concerning reciprocal representation at each other's conferences, Mr. Chew was appointed New Zealand Radio Traders' representative at the Radio Manufacturers' forthcoming conference.

Three-pin Plugs: Additional Flex

These recommendations will be considered by the manufacturers at an early date.

Draft of N.Z. Standard Specification for Tests of Electrical Appliances and Accessories

The meeting confirmed the action of the Secretary in sending a letter to the Standards Institute objecting to these draft specifications.

Badges 1952/53

Supplies are now available and associations should place their orders with the Secretary as soon as possible. Price 2s. 6d. each.

Artists Performing Rights Association

It was recommended that contracts with the A.P.R.A. should not be signed until the policy of Federation is determined.

Television

In view of recent press statements, the President reported the sending of a further letter to the Minister requesting a public statement of Government policy and an interview to discuss the question. The President was asked to arrange for the preparation of a suitable brochure concerning television in New Zealand, reference to the publication of which is to be made in the bulletin.

Electrical Appliances

Following a report (printed in *Radio and Electronics* October, 1952) presented by the Wellington Association regarding electrical appliances, it was resolved that:

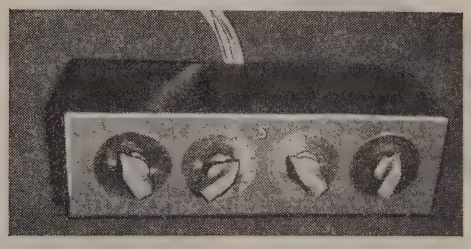
1. The Executive endorse the principle of extending the activities of the Federation to embrace domestic electrical appliances.
2. That affiliated associations be asked to extend the scope of their activities similarly.
3. For this purpose, electrical appliances be defined as domestic electrical appliances ordinarily supplied by radio dealers.
4. The Executive recommends to affiliated associations that, when receiving applications for membership from electrical traders who are not radio dealers, but who handle domestic electrical appliances, such applications should be carefully scrutinized to ensure that the applicant's business is predominantly concerned with the latter.
5. As the additional functions will probably result in an increased capitation levy (possibly by as much as 10s. per member), local associations should re-consider their membership subscription rates to provide for same and the possible additional services they may have to render.
6. The Federation proposes to handle this work for both wholesalers and retailers in a manner similar to that for radio.
7. The New Zealand Radio Manufacturers' Federation be informed of the addition of domestic electrical appliances to the scope of the New Zealand Radio Traders' Federation.

Trade-in Booklet

It was resolved that the production of this new booklet should proceed without delay. Requests are to be made to manufacturers, including new manufacturers, for details of later models. Trade-in values are to be the same percentages of original retail prices as were used in the first edition, except that no radio eligible for listing is to have a trade-in value of less than £1, and that all trade-in values be calculated to the nearest 10s.

PRE-AMPLIFIER

By Soundmaster



This accurate, high-quality versatile unit, containing two miniature valves housed internally, has been designed to satisfy the most exacting musical critics.

It provides complete control of both radio and pick-up signals fed to the main amplifier, with full compensation for L.P. and Std. records.

TECHNICAL DETAILS:

Controls, Volume, L.P. Correction, Radio/Gram, H.F. Cut.
Frequency response, 20-20,000 c.p.s.
Input, 50-150 millivolts.
Output, 1.5 volts.
Distortion, less than 1 per cent.

PRICE, £15 12s.

Trade inquiries invited

Manufacturers:

A. G. LAWFORD & CO.

ARAMOHO, WANGANUI

Sole N.Z. Agents for the famous Hartley Turner Speaker

Philips Electronic News, August, 1952: Philips Electrical Industries of New Zealand, Ltd.

In addition, the original retail price is to be shown. Mr. Young offered to rewrite the editorial preface to the new edition.

Taranaki Association

The revitalization of this Association was acclaimed, and the Association will receive the full support of the Executive.

Power Board Trading

The possibiltiy of the Wanganui Power Board entering into the appliance trading field was considered primarily a domestic matter for Wanganui and could be best combatted by the rousing of local opinion against the proposal.

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C. R. PEOPLES & CO.

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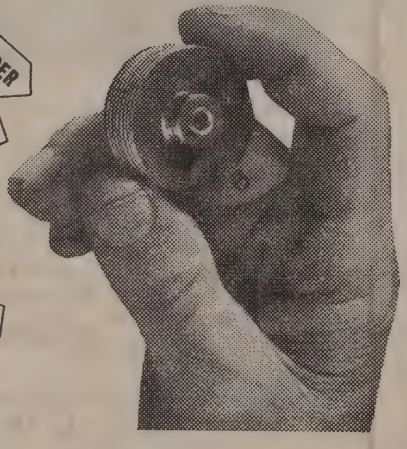

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LATEST RECORD RELEASES

(Supplied through the courtesy of Messrs. H.M.V. (N.Z.), Ltd.)

Orchestral

Toy Symphony (Haydn), Philharmonia Orchestra, conducted by George Weldon. Col. DX.1784.

Facade Suite (Walton) (5 parts); Ballabile, Ballet Music (Chabrier), Philharmonia Orchestra conducted by Constant Lambert. Col. DX.8374/6.

La Boutique Fantasque, Ballet Suite (Rossini-Respighi), Royal Philharmonic Orchestra, conducted by Efrem Kurtz. Col. DX.8393/5.

Concerto in C (Bach) (5 parts); Fantasia in C Minor (Bach) Edwin Fischer (piano solo), Edwin Fischer, Ronald Smith, Denis Matthews (pianists) with Philharmonia Orchestra, conducted by Edwin Fischer. H.M.V. DB.9573/5.

Cockaigne Overture (Elgar), Halle Orchestra, conducted by Sir John Barbirolli. HMV. DB.9633/4.

Mai-Dun, Symphonic Rhapsody (Ireland) (3 parts); April (Ireland), Dr. John Ireland (piano solo): Halle Orchestra conducted by Sir John Barbirolli, recorded under the auspices of the British Council. HMV. DB.9651/2

Symphony No. 41 in C (Jupiter) (Mozart) (7 parts); March in D. K.249 (Mozart): Royal Philharmonic Orchestra conducted by Sir Thomas Beecham. Col. LX.8759/62 (Set C.218).

Le Chasseur Maudit (The Accursed Hunter), Symphonic Poem (Franck), Royal Philharmonic Orchestra conducted by Sir Thomas Beechman. Col. LX.8813/4.

Brandenburg Concerto No. 2 in F (Bach), Danish State Broadcasting Chamber Orchestra, conducted by Mogens Woldike. HMV. C.7848/9.

Holberg Suite (Greig) (5 parts); Cowkeeper's Tune and Country Dance (Greig): Boyd Neel String Orchestra. Decca. AX.454/6.

Instrumental

Recitative and Scherzo-Caprice (Kreisler) (unaccompanied); La Gitana (Kreisler) (piano acc.): Zino Francescatti, violinist. COL. LX.1422.

Sonata in B Flat Minor (Balakirev): Louis Kentner, Piano, recorded under the auspices of the Maharaja of Mysore's Musical Foundation. COL. LX.8810/2.

Scherzo No. 1 in B Minor (Chopin): Benno Moiseiwitsch, pianist. HMV. C.3981.

Le Maschere, Overture (Mascagni): Florence Festival Orchestra, conducted by Tullio Serafin. HMV. C.4114.

Quartet in F (Ravel) (7 parts); Presto (Finale of Quartet in E Flat, Op. 33, No. 2, Haydn): Paganini Quartet. HMV DB.9452/5 (Set A.113).

Impromptu in C Minor, Op. 90, No. 1 (Schubert): Artur Schnabel, pianist. HMV DB.21320.

Four Argentine Dances for Piano and Strings (Gil): Argentine Radio Chamber Orchestra. PARL. DPX.39 (12 in. Dk. Blue).

Sonata in D Major, K.576 (Mozart): Friedrich Gulda, pianist. DECCA. AK.2168/9.

Piece en Forme de Habaneba (Ravel); Presto (Poulenc), Campoli, violinist (with piano acc.) DECCA. M.669.

Vocal and Choral

S'Nussdorfer Sternderl (Schneider); Denk' Dir Die Welt Waer Ein Blumenstrauss (Toifl): Erich Kunz,

Baritone, with "Kemmeter-Faltl" Schrammel-Orch. COL. LB.111.

Folk Songs: O Du Liebs Angeli (Bernese), Maria Auf Dem Berge (Silesian); 'S Schatzli (Swiss); Die Berumigate (Bavarian) (sung in German)—Eliszabeth Schwarzkopf, soprano, with Gerald Moore at the piano. COL. LB.112.

Magnificat (Walmisley); Nunc Dimittis (Walmisley); Rejoice O Land in God Thy Might (Knapp): Affiliated Choirs of the Royal School of Church Music (recorded at the Festival Church Service at the Royal Albert Hall, London. COL. DX.1779.

All People That on Earth Do Dwell: Jubilate (Stanford), Affiliated Choirs of the Royal School of Church Music (recorded at the Festival Church Service at the Royal Albert Hall, London. COL. DX. 1780.

Blessed Be the God and Father (Wesley): Affiliated Choirs of the Royal School of Church Music (recorded at the Festival Church Service at the Royal Albert Hall, London. COL. DX.1781.

Song of the Volga Boatmen (Trad.); Song of the Flea (Moussorgsky) (sung in Russian): Boris Christoff, bass, with Philharmonia Orchestra. HMV. DB.21305.

If Music be the Food of Love (Purcell); Music for a While (Purcell): Alfred Deller, Counter-Tenor, with Harpsichord accompaniment. HMV. C.3890.

Light Orchestral

Hora Staccato; Blue Violins: Ray Martin and His Concert Orchestra. COL. DB.2927.

Carioca (Youmans); Malaguena (Lecuona): Boston Promenade Orchestra. HMV. B.10076.

Rhonda Rhapsody (Mai Jones); Love's Roundabout (from film "La Ronde") (Oscar Strauss): Melachrino Orchestra. HMV. B.10138.

Valse de Concert, Op. 47 (Glazounov); Danza Lucumi (Lecuona): The Melachrino Orchestra. HMV. C.4098.

The Three Men, Suite (Coates) (3 parts); Dance of the Orange Blossoms (from "The Jester at the Wedding") (Coates): New Symphony Orchestra conducted by Eric Coates. DECCA. AK.2436/7.

Vendetta; Martinique: Ray Martin and His Concert Orchestra. DECCA. F.9721.

The Flying Horse; Embraceable You (featured in film "An American in Paris"): David Rose and His Orchestra. MGM.441.

Dance Orchestral, Light Vocal, Etc.

Old Time Dance Series: No. 110 Society Tango, No. 111 Glenmona-Shelagh: Harry Davidson and his Orchestra. COL. DX.1749.

Samum (Robrecht): Reginald Dixon, organist. COL. FB.3607.

Don't Make Fun of the Fair (from "The Lyric Revue) (Coward) (piano acc.); Sail Away (from "The Ace of Clubs") Coward) (orchestral acc.): Noel Coward. HMV. B.10119.

(Continued on Page 47.)

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This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. Advertising rates are charged according to space occupied. For further particulars contact Advertising Manager, R. and E., Box 8022, Wellington.

LUSTRAPHONE MICROPHONES

An excellent addition to the range of microphones available is provided by the arrival of Lustraphone Moving Coil Dynamic and Hand Microphones.

Specially suitable for portable equipment, Lustraphone microphones are, in every instance, direct replacements for any current type of dynamic or crystal microphones. A low resistance on-off switch is built into each unit. Frequency response, slightly rising within speech frequency band, is substantially flat up to 8 kc/sec, and external field is negligible. Finish is chrome and crystalline stove enamel.

Lustraphone microphones are now available from the sole New Zealand distributors, Swan Electric Co., Ltd.

* * *

RUGGER RELIABLE TUBES FOR SPECIAL APPLICATIONS

A range of three special, Noval based, "ruggedized" electronic tubes has been developed by Philips for aplications where extreme dependability, uniformity, and long life are essential.

The series contains a doube triode with separate cathodes, type E80CC (similar to the ECC40); a low-noise pre-amplifier pentode, type E80F (similar to the EF40), and a power output pentode, type E80L (similar to the EL83).

These tubes have been specially designed for hard use and are manufactured to exacting standards which ensure reliable, long life operation. In industrial electronic equipment, tube failure is not purely a matter of inconvenience, because monetary loss or loss of production in the event of failure is often much more costly than replacement of the tube. Also, where safety factors are of primary importance, very special requirements in electronic tubes must be met.

Because of their very rigid construction, these tubes will withstand impact shocks of 500 g for short periods, and 2.5 g of continuous vibrations for a hundred hours. Tolerances are considerably smaller than those of normal tubes and a life of 10,000 hours is guaranteed.

The ever-increasing applications for these tubes are numerous and include factory installations where the initial cost of tubes is secondary to maintenance costs; where uninterrupted tube performance is necessary for the preparation of a product or the maintenance of quality; for broadcasting and telecommunications in general, particularly for unattended transmitters and receivers; and for all other cases where a very safe, dependable service is paramount (airways, railway signalling and marine navigation equipment, etc.).

The following "user" prices apply: E80CC 50s. 6d.; E80F, 49s. 3d.; E80L, 51s. 6d., and supplies are available from all branches of Philips Electrical Industries of New Zealand Ltd. (Auckland, Wellington, Christchurch, and Dunedin).

* * *

A HONEY OF A PORTABLE "Pacific" and "Regent" 6P2

Already Wooller dealers all over New Zealand have given the warmest of welcomes to the 6P2, in fact, our headline quotes one of them who called it "A Honey of a Portable." It is finished in a gay pattern of two attractive colours and it's a real eye-catcher. Woollers have no hesitation in predicting that the 6P2 is going to prove one of the most popular models on the market in the summer months to come.

Apart from its grand good looks, 6P2 is truly a "portable" set; the carrying hande, dial and controls are all at the top so that it can be tuned and played while it is being carried. The weight, so important in a set like this, is only 10 lb., and the 6P2 can be converted to A.C. use simply by turning a switch. These are just some of the features that have been built into the 6P2.

Model 6P2 comes from the factory of Akrad Radio Corporation and worthily maintains the high reputation that other "Pacific" and "Regent" models have built up in the past. Great attention has been paid to detail in the production of the 6P2 and it is everything that a portable receiver should be. All external fittings are either

of plastic or nickel-plated brass to prevent corrosion; vulnerable parts have been tropic-proofed with micro-crystalline waxes, and all internal metal parts are cadmium plated.

The 6P2 is a five-valve (plus metal rectifier) receiver and all the valves used are of the miniature battery type. The circuit associated with each is designed to give maximum performance consistent with low battery drain. Each valve is mounted on a rubber-mounted socket. The loudspeaker is a Celestion 6 in. x 4 in. oval which gives excellent tone even at high volume.

The controls consist of tuning, volume, and a battery-off A.C. switch, this last having an indicator flag which shows clearly when the set is operating on batteries. The dial of the 6P2 has the frequency marked in kc/sec. as well as the main New Zealand stations; the frequency range is from 1500 to 550 kc/sec.—the broadcast band. Batteries slip into compartments and are very easily fitted.

The dimensions of the "Pacific" and "Regent" models 6P2 are: length (o.a.) 10 in.; front to back (o.a.) $5\frac{3}{4}$ in., height (o.a.) 9 in.

This set retails at £27 10s. and is distributed throughout New Zealand by G. A. Wooller and Co., Ltd., P.O. Box 2167, Auckland.

Latest Record Releases

(Continued from Page 45.)

It Makes my Love Come Down; Blue for an Unknown Gypsy based on the theme "Play Gypsy"): Humphrey Lyttelton and his Band. PARL. R.3424.

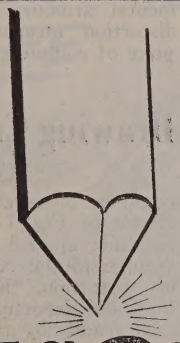
Barbyard Blue; Wolverine Blues: Joe Daniels Jazz Group. PARL. R.3425.

Bull Ant Blues (Freddy Randal and His Band; I Want A Big Butter and Egg Man: Graeme Bell and His Australian Jazz Band. PARL. R.3426.

I Want a Girl Just Like the Girl (Crane River Band); I'm Travelling (Traditional Spiritual): The Saints Jazz Band. PARL. R.3427.

One Man Went to Blow; Apex Blues (Humphrey Lyttelton and His Band): Humphrey Lyttelton playing trumpet, clarinet, piano, and washboard. PARL. R.3436.

Ciribiribin On the Mandolin; So Deep My Love: Tommy Reilly, Harmonica, with Vic Hammett Quartet. PARL. R.3444.



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Abstract Service

(Continued from Page 27.)

TELEVISION

One annoying feature of television pictures is the presence of lines which are more pronounced on a receiver with good focusing than on one with a comparatively large spot. A technique known as "spot wobbling" is now familiar and here is an alternative "spot stretching," whereby the spot is made oblong. The author's idea is to place an auxiliary focus coil next to the normal focus coil so that it assists or opposes the main focus system. The device has been put into operation with satisfactory results.

—*Wireless World* (Eng.), June, 1952, p. 221.

Faulty interlacing—a new sync. separator circuit. The fault is related to this part of the circuitry owing to differences in triggering instants and differences in the end of the frame pulses, and suggestions for improved circuitry are made.

—*Ibid,* August, 1952, p. 315.

An article deals with transmitters for U.H.F. television and certain new types of tubes being developed for commercial work with notes on video modulation.

—*Electronics* (U.S.A.), July, 1952, p. 103.

Shoes and Ships

(Continued from Page 23.)

difficulties involved. The set, in the jargon, nearly always "takes off" and is difficult to tie down. However, it can be done quite successfully by means of suitable decoupling. In this case it calls for each I.F. transformer B+ tap to be fed from the H.T. by way of a resistor of approximately 2000 ohms and bypassed by a condenser of about 0.05 μf. capacity. This should be done as close as possible to the I.F. transformer and, in fact, is frequently done inside the I.F. can so that no stray radiation can possibly cause any trouble. It is interesting to note at this juncture that the modern V.H.F. radio telephone receiver employs as many as four stages of I.F. amplification with stability. Admittedly the losses are higher at the higher I.F. frequency, but it is nonetheless an interesting achievement in decoupling.

Philips Experimenter

(Continued from Page 25.)

grid of the QQE06/40 instead of dropping the plate supply voltage. In this circuit, a supply of 250 volts is used, with a dropping resistor of 25k. from the plate of the modulator to the screen of the modulated stage. The performance of this arrangement is slightly superior to that of the Fig. 4 circuit, since with it, it is possible to reach 100 per cent. modulation with good waveform. The carrier power at full modulation is almost exactly the same as with the previous circuit, but the carrier shift is in the opposite direction. That is to say, the carrier power at 100 per cent. modulation is slightly less than that under unmodulated conditions. With 750 volts on the plate and a modulator supply voltage of 250, the screen voltage is 145 with no modulation applied. The screen current rises from 1.6 ma. at zero modulation to 2.2 ma. at 100 per cent., thus accounting for the decreased carrier power. However, better linearity is obtained in the modulator valve, whose plate current remains constant at 24 ma.

Measuring Distortion

(Continued from Page 12.)

precision measurements are required, but it does emphasize that all possible precautions should be taken to prevent hum from arising in the distortion meter itself. If it does, this hum will be charged against the gear under test, and could be the cause of much unnecessary heart-burning!

The third point has been touched upon above, but is worth repeating here. It concerns the purity of the oscillator waveform. Supposing the oscillator output is not properly undistorted, this distortion will also be charged against the amplifier under test, and for precise work, this cannot be allowed to occur. As before, it still need not affect the usefulness of the arrangement, provided it is realized that absolute measurements are not likely to be very accurate, and that comparisons are the only things that can accurately be made.

Before leaving the distortion meter, it should be emphasized that in spite of the theoretical imperfections of the simple arrangement we have described, it will still be found an exceedingly useful tool, for which to our knowledge no competitor exists, and in consequence, it should be a very welcome addition to the instrumental armoury of all those who feel the need for distortion measurements, but who cannot afford the price of commercial instruments.

Drawing Curves on an Oscilloscope

(Continued from Page 37.)

could be observed much more readily. In this case, the circuit of Fig. 1 would be used, with the output of the amplifier applied to the Y input terminal, and the input voltage to the X input terminal. If there is absolutely no distortion, the result will be an exactly straight line, and departures from straightness can be estimated very readily by measuring the pattern with a ruler. However, enough has been said to illustrate a general method of attack for making oscilloscope curves more real and therefore more useful. It is hoped that many of our readers will find the article of assistance in their work, whether amateur or professional.

Proceedings of N.Z.E.I.

(Continued from Page 33.)

ments for this project are well advanced and members will be kept informed of the progress achieved by medium of these Proceedings.

CLASSIFIED ADVERTISEMENTS

I.R.E. PROCEEDINGS

Advertiser desires to obtain back numbers of Proceedings of Institute of Radio Engineers (U.S.A.) from 1932–1948. Reply stating condition and price to IRE, c/o R. & E. Box 8022, Wellington.

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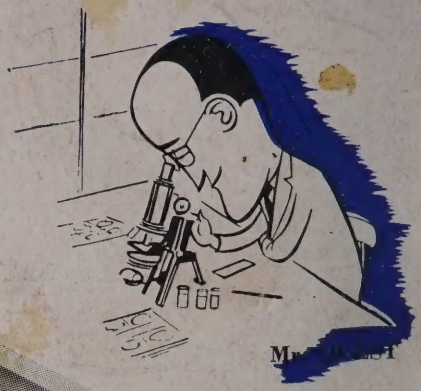

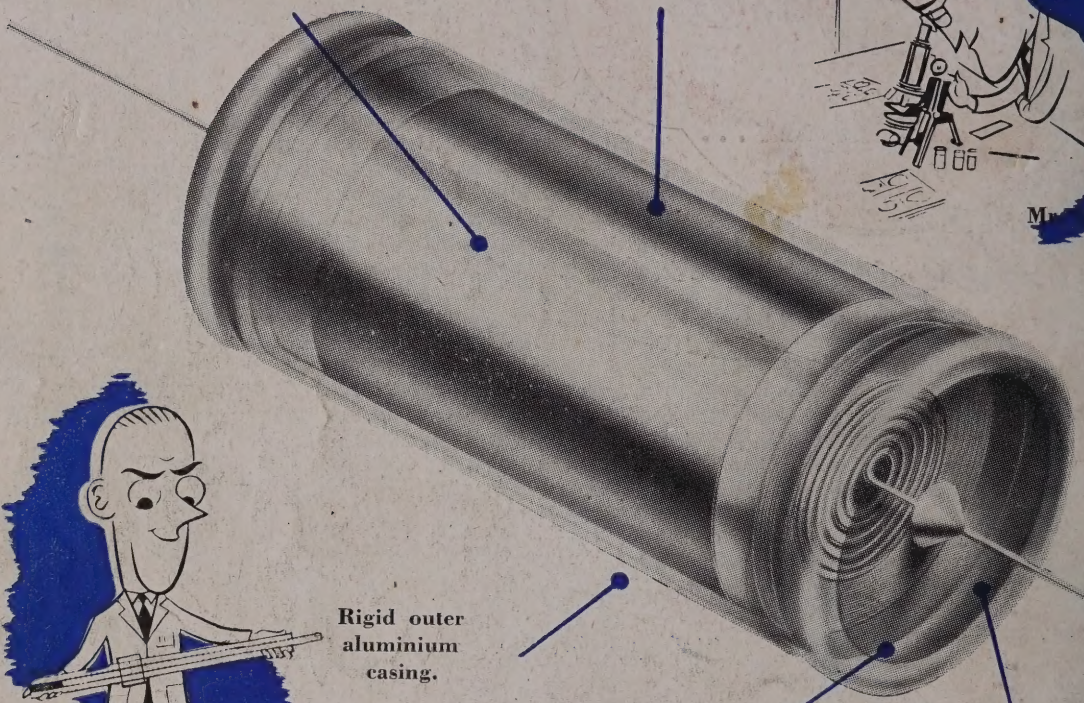

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Full hermetic rubber sealing to tube and rivet.

Spiral Wire connection for maximum contact to element brought out through rivet and soldered.

T.C.C. "Metalpack" Super Tropical condensers have proved themselves eminently suitable to meet the stringent conditions present in all the latest electronic apparatus such as navigational aids for both service and commercial use.

While maintaining the high standards of quality found in all T.C.C. condensers, their compactness and ability to withstand extreme temperature variations from — 40°C. to + 100°C. make them the obvious choice of the design engineer.

T.C.C. "Metalpack" condensers can be supplied fitted with insulating sleeves to special order.

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